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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 2556
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS 2558
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 2558
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2558
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) 2560

89 ASTRONOMY 2564
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2565
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2565
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 2566
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2567
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 2567

Note: N.A. means that no abstracts were assigned to this category for this issue.

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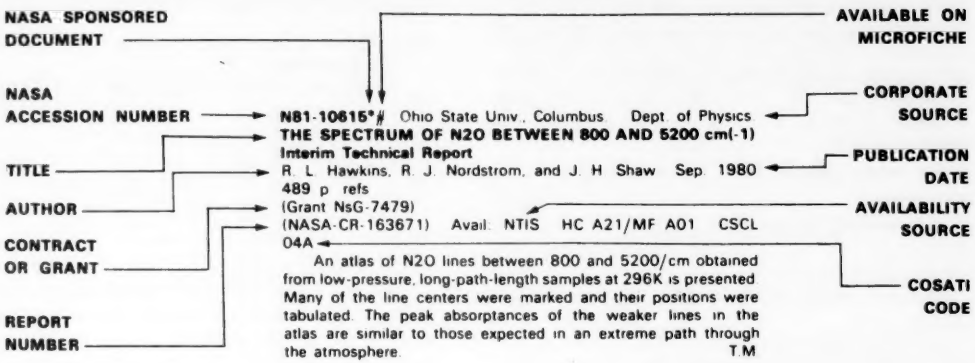
TYPICAL CITATION AND ABSTRACT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NASA ACCESSION NUMBER
N81-10615*# Ohio State Univ., Columbus Dept. of Physics
CORPORATE SOURCE
THE SPECTRUM OF N2O BETWEEN 800 AND 5200 cm(-1)
Interim Technical Report
TITLE
R. L. Hawkins, R. J. Nordstrom, and J. H. Shaw Sep. 1980
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An atlas of N2O lines between 800 and 5200/cm obtained from low-pressure, long-path-length samples at 296K is presented. Many of the line centers were marked and their positions were tabulated. The peak absorptances of the weaker lines in the atlas are similar to those expected in an extreme path through the atmosphere.
T.M.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

1.0001, INTEGRATED CONTROL SYSTEM ENGINEERING SUPPORT

W.H. Clark, Systems Control Inc., *260 Sheridan Ave., Palo Alto, California* 94306 (DF143670; F33615-79-C-3614)

The Air Force function addressed by this effort is avionic/flight control integration concepts for future aerospace vehicles. The problem has been the proliferation of non-standard avionic systems in aircraft with resulting increased life-cycle cost and decreased flexibility. The objective of this effort is to study the effects of applying avionic hardware and standardization concepts to aircraft flight control/crew systems tasks. This work will determine the applicability of these concepts by simulation testing in a flight engineering facility to be developed during the course of this effort.

The Flight Engineering Facility (FEF), which will be developed during the course of this effort, will provide a hot-bench facility for evaluation of the hardware and software concepts. The development of the FEF will be an evolutionary process, with experiments being performed as the facility develops.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0002, SECOND-GENERATION COMPREHENSIVE HELICOPTER ANALYSIS SYSTEM

I.C. Statler, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Aeromechanics Lab., *Moffett Field, California* 94035 (DA0G2727)

The objective of this task is to develop and demonstrate a second-generation comprehensive helicopter analysis system which is a system of methods for predicting loads, aeroelastic stability and control, and performance for rotary wing aircraft of various sizes and rotor types. The system will be applicable in preliminary design and development support and in research activities. Accurate prediction is needed to reduce development risk for new helicopters, to prevent delays in deployment of new aircraft, and to reduce reliability and maintainability problems of operational aircraft.

A government-industry working group (GIWG) has been established to prepare specifications for the system and to define details of the approach to be taken. The majority of the work will be accomplished through contracts with industry (software firms) and grants to educational institutions. After the system is developed, it will be validated by correlation with experimental data. This program is fully coordinated with NASA rotorcraft research analysis and test plans. The rationale for this approach is to obtain maximum user involvement in the development of the system. Foreign state-of-the-art trends and potential threats to present and future systems have been considered in planning this task.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Aeromechanics Lab.

1.0003, AIRCRAFT GROUND MOBILITY SYSTEM (AGMS) DESIGN AND FABRICATION

J.P. Forsyth, Vehicle Systems Development Corp., *1251 W. 9th St., Upland, California* 91786 (DA0G2482; DAAK51-80-C-0010)

To provide a ground support system to significantly increase the ability of fighter aircraft to traverse soft and/or rough terrain in order to mobilize aircraft from parking areas to, and from, usable runways in a combat threat.

Using the wheeled aircraft landing gear flotation improvement technology developed under contract DAAJ02-77-C-0077,

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0004, SUBSYSTEM STATUS MONITOR

H. Harper, United Technologies Corp., Sikorsky Aircraft Division, *N. Main St., Stratford, Connecticut* 06602 (DA0E3850; DAAK51 78 C 0023)

To determine the technical feasibility and application practicality of a central information processing and crew advisory system for advanced Army helicopter applications. The system will use on-board computer technology to interrogate the subsystems, analyze collected data, and provide advisories to the crew on a multifunction cockpit instrument.

The approach involves five tasks: a. Parameter identification and analysis. b. Define information-handling format. c. Define hardware/software. d. Evaluate effectiveness. e. Identify peripheral functions.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0005, TURBULENT FLOW IN S-SHAPED DUCTS

J.P. Sullivan, Purdue University, School of Aeronautics & Astronautics, Dept. of Aeronautics & Astronautics, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (DN875792; N00014-78-C-0710)

Obtain fundamental and experimental data useful to an understanding of the detailed interaction of turbulent shear layers in a two-dimensional S-shaped duct with grid-generated and fully developed turbulent flows at entry. This information is pertinent to (a) the establishment of design procedures for S-shaped ducts in which it is desired to obtain the maximum mass flux with the lowest pressure losses and distortion; and, (b) optimization of performance and predictive capability of advanced engine and component configurations for military applications.

Performance parameters of interest in S-shaped ducts are velocity, pressure, turbulence quantity profiles, mass flux, pressure loss, and distortion. Measurements will be made by laser-Doppler velocimetry.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0006, DYNAMIC ENGINE SIMULATOR

J. Sturgess, Propulsion Dynamics Inc., *Annapolis, Maryland* 21401 (DN096151)

Design and develop a working model of a dynamic engine simulator, utilizing state-of-the-art technology, which will fully simulate the actual start-up and sustained operation of a turbojet/fan engine.

The full measurement and testing capabilities of all turbojet/fan engine test systems presently in use or in production must be identified. Also, testing requirements and parameter relationships of a sample jet engine must also be identified. A mathematical model of a jet engine must be developed and a working model of a dynamic engine simulator must be designed,

developed and constructed. Additional software will be developed for other engines.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Engineering Center

1.0007, FLIGHT TRAJECTORY CONTROL INVESTIGATION

M.W. Bird, Lear Siegler Inc., *4141 Eastern Ave., Grand Rapids, Michigan* 49508 (DF141380; F33615-78-C-3607)

The Air Force function for this effort is to study and develop advanced techniques for real-time flight trajectory generation and execution of complex flight paths for advanced military transport aircraft. Future mission requirements and air traffic control constraints will present significant pilot work load and performance problems to flight crews if additional capability is not provided by enhanced flight control system features. The objective of this effort is to develop a set of algorithms suitable for on-board computation of complex trajectories which also interface with pilot displays to minimize crew duties. This development will provide the Air Force capability to operate in future civil and military environments not possible with current aircraft equipments.

Development of trajectory generation software. Software validation and capability demonstration via computer-based engineering simulation. Definition of display requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0008, UNSTEADY LIFTING SURFACE THEORY

J.E. Yates, Aeronautical Research Associates of Princeton Inc., *50 Washington Rd., Princeton, New Jersey* 08540 (DN675261; N00014-77-C-0616)

The development of accurate methods for the calculation of unsteady loads on wings is essential for the prediction of their response to gusts, and for the prediction of their aeroelastic behavior. The objective of this research is to extend inviscid unsteady aerodynamic theory for thin airfoils to include viscous effects at the trailing edge, and then to extend this result to three-dimensional wing theory.

Unsteady analyses for aerodynamic design have been based largely on inviscid linearized theories which incorporate Kutta condition modeling. This research is directed to the development of a thin, viscous airfoil theory to better describe the flow about airfoils and about wings in general. The equations of motion used in thin airfoil theory will be modified to include the viscous terms and a solution of the resulting equations sought.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0009, EVALUATION OF A PROPOSED HOLD-DOWN SECURING SYSTEM CONCEPT FOR VERTICAL LANDING AIRCRAFT

D. Earl, Bell Aerospace Textron, *P.O. Box 1, Wheatfield, Buffalo, New York* 14240 (DN081328; N62269-79-C-0490)

To substantiate and demonstrate performance predictions for a suction hold-down securing system concept, so that the feasibility and utility of the concept can be determined. This contract supports work unit DH830, Agency Accession No. DN 181042.

Tests and modifications of a GFE, half-scale, rigid skirt hold-down securing system model will be performed and evaluated to determine the performance of alternative full-scale configurations. An optional preliminary design and aircraft integration task will be included to evaluate the impact of the cncept on aircraft design, weight and performance.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Systems Directorate

1.0010, STUDY TO SIMULATE AIRCRAFT SENSOR DISPLAYS FOR ENGINEERING FLIGHT SIMULATION

G.J. Brooking, Singer Co., *Binghamton, New York* 13902 (DF144280; F33615-79-C-3621)

The application of engineering flight simulation for the evaluation and development of current and future Air Force systems is increasing. Newer simulations are demanding greater capability and accuracy from flight simulation systems. The objective of this work unit is to meet these demands by interfacing and integrating new equipment into the AFFDL flight simulation system as well as increasing the performance of existing equipment. As a by-product of this effort, reliability and maintainability of simulation systems will be increased. The end-product of this effort will be enhanced utility and validity of simulation program results.

An investigation of currently available equipment required to meet future simulation needs will be conducted and studies made to determine the feasibility of interfacing this new equipment with the existing system. Included is the adaptation of a newly obtained radar land-mass simulator, addition of new computer peripheral devices, and increased hybrid computation capability (primarily through the installation of digital controlled interface between the EAI 8400 digital and EAI 781 analog computer). The approach to interfacing this equipment will include determination of system performance requirements, project planning, and complete testing and documentation. Complete testing will require the performance of experiments to determine the accuracy of the new and existing equipment. The results will be used to establish the methods for increasing the accuracy of the equipment, if necessary.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0011, DEVELOPMENT OF ELECTRONIC MEASUREMENT SYSTEMS FOR SIMULATION TESTING OF MULTI-MISSION MILITARY VEHICLES FROM LOW/HIGH-SPEED FLIGHT REGIMES

J.H. Bieber, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF120720)

Advanced strategic flight vehicles will require configuration design changes to independently provide combined flight characteristics such as maneuverability, speed, control and stability throughout the entire environment that the vehicle is subjected to inflight. A comprehensive understanding of the aerodynamic flow characteristics that these vehicles must encounter during extensive realistic operational testing is lacking but is essential for optimum design. Overcoming deficiencies most effectively and rapidly can be accomplished by the testing of proposed aerodynamic configurations in ground simulation test facilities. This requires the measurement of such aerodynamic parameters from test models as force pressure, temperature and heat rates. Frequently, commercial electronic instrumentation will not provide the quality of data required. The effort is to develop the circuitry necessary to effectively interface equipment into systems that meet the desired measurement goals in these test facilities.

All available data on pilot rating and human response measures will be collated into functional expressions of flying qualities. Computer analysis - analog and digital - will be implemented to assure rapid and accurate data analysis and formulation of models for estimation of flying qualities given vehicle dynamics and flight condition. Methods utilized in the VTOL program will be extended for conventional vehicles.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0012, ADVANCED CONTROL DISPLAY CONCEPTS FOR FLIGHT CONTROLS OF AIRCRAFT WITH ADDITIONAL DEGREES OF FREEDOM AND PERFORMANCE CONSTRAINTS

S. Burdess, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141740)

This work unit supports TPO 3, Flight Control, and major thrust FG02, Crew Systems Integration. The function of this effort is to investigate advanced controls and displays. Deficiencies now exist for aircraft with new flight control modes including AFTI, V/STOL, CCV, etc. The objective is to first determine the control display needs, if any, and then, through total crew systems integration, identify the pilot interface requirements to implement advanced control modes into military air-

craft. This program relates to the military mission by providing inputs to programs such as AFTI, CCV and IFFC concerning future crew systems technology.

Advanced control techniques and scenarios for various Air Force missions are being studied to identify crew systems deficiencies. In essence, this means working closely with other programs like AFTI to identify the salient crew systems technology issues and also integrating the results of related cockpit design studies. Efforts will then concentrate on identifying the work needed to resolve these crew systems technology deficiencies. The final product will be the criteria for crew systems technology development.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0013, STABILITY AND CONTROL PREDICTION METHODS

D.E. Hoak, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF133300)

This work unit supports TPO 3, Flight Control, and specific goal FG02B, Flight Control System Design Techniques. The problem involved in accurately defining aerodynamic stability and control characteristics is critical to the successful accomplishment of both strategic and tactical combat missions. This objective is to continually examine new data and theoretical knowledge concerning the understanding and prediction of aerodynamic phenomena, with particular attention given to those aspects pertinent to stability and control. Also, an awareness of existing and potential problems in this area must be fostered to insure appropriate application of existing knowledge and to form a basis for the formulation of programs to overcome critical deficiencies. Overcoming these deficiencies will significantly enhance the design of military aircraft by assuring that methods are available for determining satisfactory stability and control characteristics and for evaluating the effects of engineering fixes.

Studies of existing and new aerodynamic theory and experimental data compilations will be implemented to establish a comprehensive technology base. Attention will be focused on vital areas in which problems exist or are foreseen and in which technology is deficient. Programs will be planned, and analytical, empirical and graphical relations will be developed to improve the prediction of aerodynamic stability and control characteristics for all classes of flight vehicles.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0014, FLIGHT CONTROL SYSTEM DEVELOPMENT CRITERIA

T.D. Lewis, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF138620)

Analysis tools to predict aircraft flight control/weapon system performance and cost estimates are inadequate to be applied early in the design cycle. Also, newly emerging flight control technologies require a firm data base and experience factors to be included in military specifications. The objectives of this effort are to: (1) refine and consolidate the flight control system (FCS) development analysis, evaluation, and life-cycle cost (LCC) prediction techniques, and (2) develop, refine, and revise military specifications for flight control system design, development, test, and evaluation. FCS specification revisions will incorporate newly emerging technology and aid in reducing FCS design and test time. Consolidation and refinement of analysis techniques will provide criteria for realistic system performance and cost estimates early in the design cycle.

Digital flight control system experience will be broadened through support of the A-7 digital multimode FCS test aircraft while in use at the test pilots school, through experience gained on the digital flight control system ADP, and through interaction with work on related programs performed by other agencies for application and incorporation into MIL-F-9490D. Development of a new specification for servo-actuators will continue. Review and update of MIL-V-27162, Servovalve Specification, will be initiated. Review, refinement and consolidation of FCS analysis programs such as TAWDS, DIGIKON, MAPS, and FCS LCC prediction will be conducted as applicable. Coordination with AFLC ALCs and the USAF Safety Center will be conducted along with review of FCS safety, survivability, reliability, and maintainability data to establish criteria for future FCS programs and specification update.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0015, SMALL-SCALE MILITARY FLIGHT VEHICLE TECHNOLOGY

D.T. Lowe, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143010)

This effort supports development of advanced configurations of remotely piloted vehicles (RPVs). Currently, aerodynamic-efficient drone vehicle designs which can be produced cheaply and are expendable do not exist. The objective of this effort is to develop and test the technologies to produce inexpensive, lightweight, small-scale drone vehicles. The configurations and subsystems developed in this effort will provide attractive low-cost options for carrier vehicles to conduct such military operations as defense suppression, target strike, ECM or reconnaissance.

Examine and adapt available hardware and concepts from small military drones. The major difficulties will be in achieving sufficient size reduction and low cost to meet cost and weight goals. The airframe design configurations will be proven by wind tunnel and flight testing. Low-cost flight stabilization and control subsystems will be considered, as will radar cross-section and survivability. Developments from airframe and avionics contracts will be integrated into final designs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0016, FLAT PANEL SELF-HEALING VERTICAL SITUATION DISPLAY

J.R. Pastor, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144540)

This work unit supports advancement of aerospace vehicles under TPO 3. Criteria are required which determine the legibility of a dot matrix display when display degradation has occurred. Presently these criteria do not exist. Without them there is no way to predict the useful life of a display. The objective is to validate the method of approach and generate criteria for dot loss of two fonts that could be used to develop a display that could heal itself when dot losses occur by moving the script to a legible position. The criteria could also be the bases for airworthy specifications for purchase of flat panel displays. Presently there are no criteria on which to base such specifications.

Complete an interactive program which uses Fourier transforms as models of the human visual system. Use this program as a tool to define most likely worst case degradation in a preliminary analysis step to define the test population. Conduct experimentation exposing subjects to numerics. Conduct experimentation with subjects responding to a degraded vertical situation display. Complete report. Additional comments - the criteria discussed herein for numerics are also essential for the alphabet. Therefore, a complementary program which is a natural extension of this work unit will be initiated prior to the conclusion of this study.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0017, PROPULSION TECHNOLOGY

C.L. Walker, U.S. National Aeronautics & Space Admin., Lewis Research Center, *21000 Brookpark Rd., Cleveland, Ohio* 44135 (DA0E3532)

Conduct exploratory development programs for advanced propulsion and drive train components relevant to future Army aircraft application. Provide technological basis for evaluation of concepts for improvement and application, including considerations for related needs in materials and fabrication techniques.

Analytical and experimental studies are conducted on Army-funded, NASA-administered contracts with private industry and universities. Typical programs involve analysis, design, fabrication, and test of breadboard hardware. The primary areas

to be emphasized are related to turboshaft engine technology and associated helicopter drive-train systems. Components considered include inlet particle separators, compressors, combustors, turbines, seals, bearings, shafting, gears, clutches, couplings, and thrust producers.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Propulsion Lab.

1.0018, AIRCRAFT FORCE MANAGEMENT METHODS

A.P. Berens, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF140570; F33615-77-C-3122)

MIL-STD-1530 requires airframe contractors to provide USAF with a force management data package which includes the procedures and techniques necessary to maintain aircraft structural integrity. To date, the elements involved in managing a force of aircraft to protect structural integrity have not been adequately developed. This procurement will support MIL-STD-1530 by developing the necessary force management methodology, including individual aircraft tracking, operational usage monitoring, and maintenance forecasting. The results of this program will be used to establish efficient force management techniques and procedures, thereby reducing costs and maintaining structural integrity of USAF aircraft systems.

This effort will include the development of methodologies for the various elements involved in force management. Necessary complexity and duration will be determined for usage-monitoring programs to be used for developing baseline operational spectra and detecting significant changes in usage. Individual aircraft tracking techniques will be developed which are realistic compromises between ideal tracking programs and economic/logistic constraints. Optimum procedures for forecasting maintenance actions will be established.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, EFFECTIVENESS TESTING ON CH-47C HELICOPTER TRANSMISSION

J.W. Lenski, Boeing Co., *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DA0G0399; DAAK51-79-C-0021)

To assist a flight test program, to assess the selective stiffening characteristics of doubler plates, by fabricating the required plates and performing the bonding of the Plateson CH-47C forward transmission case.

Fabrication of plates will be accomplished by DWA Associates, Chatsworth, CA. Boeing-VERTOL will bond the plates onto a CH-47C forward transmission and ship it to Ft. Rucker, AL for noise reduction evaluation.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0020, ADVANCED TECHNOLOGY WING STRUCTURAL COMPONENT

W.A. Poindexter, Vought Corp., Vought Aeronautics Division, *P.O. Box 5907, Dallas, Texas* 75222 (DF138220; F33615-76-C-3138)

Increasing acquisition and life cycle costs of aircraft have focused attention on the development and demonstration of new airframe structures technology which will provide reduced ownership cost while improving structural durability and vehicle performance. The objective of this effort is to demonstrate feasibility of selected low-cost advanced wing box structural concepts applicable to future tactical and strategic aircraft. Design concepts will consider use of both metallic and composite materials coupled with innovative design approaches. Program results will provide candidate technology and hardware-demonstrated structural alternatives for advanced development and future systems application.

Structural wing-box components representing a 10 ft. inboard section of a variable camber supercritical wing configuration will be designed, fabricated, and tested to show concept feasibility. Acquisition, maintenance, and repair cost comparisons will be generated against conventional machined-aluminum wing-box structures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0021, UNATTENDED/EXPENDABLE DRONE-BORNE HOMING SYSTEM

D. Ingebretzen, Melpar Inc., *7700 Arlington Blvd., Falls Church, Virginia* 22046 (DA0G0499; DAAK51-79-C-0002)

The technical feasibility of destroying communications transmitters by using an unattended/expendable drone-borne RF homing and explosive system is to be demonstrated.

Three existing lightweight, low-cost drones capable of flying without commands from the ground will be modified to incorporate an RF-seeker. The seeker will supply steering commands to the drone's autopilot to enable the drone to dive on the ground-based RF-emitter. A simulated RF-emitter will be set-up and the drones launched to make repeated dives with pull-outs prior to impact. Photo data will be taken to obtain estimated impact points. Final flights will include a completed dive on the target to demonstrate the accuracy.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0022, APPLICATION OF THE OPERATIONAL LOADS SURVEY (OLS) DATA

D.J. Merkley, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3863)

Investigate and document selected aerodynamic and structural flight test data associated with the helicopter during operational maneuvers, to include the following topics: the effect of compressibility on rotor pressure distributions and maps of shock locations; the effect of vortex interactions on rotor pressure distributions and maps of vortex interactions; blade stagnation point locations as a function of azimuth-blade model participation factors based on various combinations of strains, accelerations and displacements; comprehensive analysis of simultaneously recorded data for selected flight conditions to allow for correlation of simultaneous events and correlation with analysis. The resulting documentation will aid the design, evaluation and development of improved rotor systems and helicopters to meet future Army operational needs.

The required procedures to investigate each of the above topics will be defined. Each of these topics will be investigated and documented separately with the aid of the Data Management and Analysis System data-map (data from aeromechanics' test and analytics-management and analysis package, formerly known as OLS-DMS).

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0023, DOCUMENTATION OF A STRIP ANALYSIS METHOD FOR PROPELLERS AND ROTORS IN AXIAL FLOW

W.A. Pleasants, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0G2723)

To provide a software package which combines all capabilities of the current prop routine in a single program and documents the theory, code, and application of the analysis method.

Existing programs shall be combined to generate a single program capable of treating fixed-pitch and variable-speed propeller performance, non-dimensional rotor performance in hover and climb, and complete configuration analysis in hover and climb. The documentation of theory, code, and correlation shall be updated.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0024, MIXING OF SWIRLING FLOWS AND BEHAVIOR OF WET FLOWS

G.C. Oates, University of Washington, School of Engineering, Dept. of Aeronautics & Astronautics, *206 Guggenheim Hall, Seattle, Washington* 98105 (DF052130; F49620-78-C-0063)

AF function - advanced turbomachinery. Opportunity - improve our understanding of the flow through an axial flow turbomachine. Objective - to conduct an investigation into 1) the mixing behavior of swirling flows, and 2) the effects of water droplets and water vapor on the flow processes within transonic fans. How work contributes - will provide fundamental knowledge needed in order to provide solutions to two constantly reappearing problems of high-performance turbomachinery.

An investigation will be conducted in two areas. In the first area, which will study the effect upon mixing by swirling the inner stream of two co-annular streams, the first step will be to construct the required test facility. Once completed, detailed investigations concerned with obtaining data on the mean flow will be carried out. Parameters to be varied will include degree of swirl, pressure gradient and variation in geometric shape of inner annulus. In addition, a theoretical investigation will be carried out with the goal of developing a method capable of predicting the mixing behavior of swirling flows. In the second area, which will study the effect of water droplets and water vapor on the flow processes, the experimental study will study the behavior of water droplets passing through a shock. An extension of Marble's theory would also be undertaken. Results of analysis and experiment would be compared.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, CHEMISTRY OF POLYNITROETHANE DERIVATIVES 16196-C

K. Baum, Fluorochem Inc., *6233 N. Irwindale Ave., Azusa, California* 91702 (DA0G8995; DAAG29-79-C-0011)

The preparation and characterization of sym-tetranitroethane, hexanitroethane and tetranitroethylene will be attempted and the mechanism of the reactions involved studied. Relevance - the simple polynitrocompounds are expected to be exceptionally high in energy content, and could be valuable propellant oxidizers or components of explosive mixtures.

Various coupling reactions will be employed, as will displacement and elimination processes, and oxidation and reduction.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0002, ANALYSIS OF AIRCRAFT ENGINE OIL SAMPLES BY NEUTRON ACTIVATION TECHNIQUES

T.A. Menard, U.S. Dept. of Defense, Air Force, Air Force Academy, Physics Dept., *Colorado Springs, Colorado* 80840 (DF282210)

A continuation of the feasibility study conducted during 1976, this study will attempt to determine the feasibility of using a Cf252 neutron source for activating aircraft oil samples as a means of supplementing the USAF spectroscopic oil analysis program. This project will determine if the neutron activation method is faster and/or more accurate than presently used methods of determining trace contaminates in oil.

A Cf252 source will be obtained on loan from ERDA. Calibration standards will be prepared and curves established for the 13 elements of interest in oil analysis. The approach will be to determine the optimum method for observing each element in order to obtain the lower limit in ppm plus or minus 10 percent. Aircraft engine oil samples will be activated and the trace metal concentrations determined using the calibration curves. By comparing these results with those obtained by the SOAP methods, a conclusion can be drawn concerning the value of this method in relation to the established methods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab.

3.0003, MONOGRAPH ON MOLECULAR BEAM SOURCES

J.B. Fenn, Relay Development Corp., *Branford, Connecticut* 06405 (DN075063; N00014-80-C-0055)

The objective of this effort is to produce a monograph covering the present state of knowledge and understanding of the behavior and the limitations of free jet sources utilized in molecular beam research. Advances in molecular beam technology and experiments made in recent years have provided rich sources of information on the basic structure and energy levels of molecules, as well as the details of their collisional interactions with each other and with surfaces. A critical treatise on the subject from the point of view of beam performance and specific research applications will provide a valuable source of literature and be of specific importance in chemical kinetic, nucleation, condensation, and vaporization studies - all of concern to advanced propulsion systems.

The compendium of available molecular beam source descriptions will gather together the experience and critical judgment of two of the acknowledged leaders in the field and cover the most recent developments in molecular beam technology, in this country and abroad.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0004, HIGH-CYCLE FATIGUE MECHANISMS

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Study mechanisms of high-cycle fatigue at high load ratios, r, in titanium alloys to provide more certain diagnostic failure analysis criteria and to provide basic information needed to improve resistance to such failures. Some attention may be given to other alloys as seems necessary.

Conduct fatigue experiments simulating important aspects of service conditions, evaluating effects of applied stresses, metal surface condition and environment and fretting on mechanisms of crack initiation and propagation. Compare with similar fractures produced by other causes such as SCC. Identify compositional and microstructural factors leading to best fatigue resistance, and produce systematic failure analysis criteria.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0005, FLOW AND FRACTURE PROCESSES IN POWDER METALLURGICAL NICKEL-BASE SUPERALLOYS

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AF function - nickel-base superalloys, because of their unique high-temperature properties, find extensive application in the turbine section of gas turbine engines. Opportunity - as the performance requirements of such aerospace power plants become more demanding, the material properties must be improved to compensate for the more severe operating conditions. However, the specific property improvements required in an alloy depend upon the component for which it is to be used. For the airfoil section of a blade, high-temperature creep and rupture properties coupled with good thermal fatigue resistance are critical properties. For a turbine disk, which operates at lower temperatures, improved engine performance translates into requirements for higher strength materials with superior stress rupture characteristics. Objective - this research will obtain insight into the factors and mechanisms that control the strength and stress-rupture properties of powder metallurgy nickel-base superalloy disks fabricated by hot isostatic pressing. How work contributes - as such, it will contribute to AF programs to exploit advanced cost-effective manufactu..ng methods

(hot isostatic pressing of nickel-alloy powders) for the production of critical engine components.

Two basic mechanical properties of nickel-base superalloys fabricated by powder metallurgy techniques have been selected for study - stress rupture, and strength with emphasis on the yield stress. Several alloy compositions, including MERL-76, will be selected for detailed mechanical and microstructural characterization. Quantitative models will be constructed by the mechanical processes, and related to experimental observations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0006, THE DEVELOPMENT OF HIGH RESOLUTION X-RAY EMISSION SPECTROSCOPY FOR MOLECULAR ELECTRONIC STRUCTURAL STUDIES

G. Andermann, University of Hawaii System, Manoa Campus, School of Arts & Sciences, Dept. of Chemistry, *2444 Dole St., Honolulu, Hawaii* 96822 (CHE78-24884)

The proposed studies deal primarily with the continuation of development of high and ultra-high resolution X-ray emission spectroscopy (XES) as a laboratory analytical tool for studying molecular electronic structure. The proposed instrumentation development includes the completion of the conversion of the present 5M grating spectrograph into a complete monochromatic system with the objective of yielding a factor of about 5 to 10 in speed of analysis over current photographic capability. The proposed studies on analytical applications include the continuation of present research on defining the capabilities of XES as a central atom, pseudo-central atom, and a ligand atom probe for deciphering molecular electronic structure. These studies will concentrate on the utilization of the grating spectrometer with emphasis on C, N, and O K-emission and Cl, S, P, Si, and Al L-emission transitions, with the objective of gaining further insight into chemical bonding. Finally, studies are proposed to initiate the development of X-ray radiation damage; more specifically, the investigation of the possibility of ligand orbital specificity in radiation damage, an area of great potential applications for biologically important molecules. This is a continuation of the research currently in progress under NSF Grant CHE77-11275.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0007, INITIATION MECHANISMS OF SOLID ROCKET PROPELLANT DETONATION

A. Takata, I I T Research Inst., *10 W. 35th St., Chicago, Illinois* 60616 (DF040790; F49620-80-C-0007)

AF function - this effort directly responds to requirements specified in research objective 5.1. Future missile systems will employ nitramine propellants. Deficiency - current attempts to develop Navy systems using these propellants have experienced unscheduled detonations. Objective - this contract seeks to identify the causes and mechanisms of deflagration to detonation transition. How work contributes - permits the use of high energy propellants for optimized propulsion performance without creating unreliable systems.

Experiments will be conducted to determine thresholds for deflagration to detonation transition (DDT) as a function of foam mass and temperature as well as minimum crack width. The current crack gas flow model will be upgraded to determine the extent to which foam layers may be augmented by the flow of molten propellants within cracks. Experiments will also be conducted to determine HMX foam masses during steady burning at near ambient pressures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0008, NONLINEAR OPTICAL PROPERTIES OF LIQUID CRYSTALS 14280-P

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To study the laser-induced nonlinear optical effects in liquid crystal material. Intense laser light interacting with liquid crystal materials may produce completely new physical phenomena. New electrooptical devices are possible and will be explored.

To study the static field-induced second harmonic generation in the isotropic phase of liquid crystal. In the absence of a d.c. field, the orientation of the molecules in the liquid crystal is randomly distributed; therefore, it would interfere destructively and have no significant second harmonic generation. When a d.c. electric field is present and a new alignment induced, the liquid crystal material can give rise to coherent second harmonic generation. The second

The second experimental program will be to study the optical field-induced isotropic nematic phase transition.

Sum frequency generation, three-wave mixing and dispersion of optical Kerr effect: it is planned to study three-wave mixing in both the anisotropic and isotropic phase of nematic liquid crystal.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0009, PROPERTIES OF COMPOSITIONALLY MODULATED ALLOYS

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This is an investigation of the magnetic and superconducting properties of Cu-Ni, Ni-Pd, Pb-Sb, Nb-Ge and Pb-Bi foils containing short wavelength (8-80 AO) composition modulations produced by vapor deposition. These alloy systems will be investigated to determine if magnetic anomalies occur, and whether metastable crystal structures can be fabricated. These crystal structures may have a high superconducting transition temperature. Another objective of this study is to determine the d-shell interactions and their correlation to magnetic and superconducting properties. It is expected that the results of this research will constitute an important addition to our fundamental knowledge in microstructural science.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0010, A PROGRAM LEADING TO SPECIFICATIONS FOR AVIATION TURBINE FUEL PRODUCED FROM WHOLE CRUDE SHALE OIL

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The objectives of this program are to optimize new procedures for the efficient and economic processing of whole crude shale oil into high yields of military fuels while maximizing the yield of aviation turbine fuel and to determine the trade-offs between jet fuel yield, jet fuel properties, and processing costs.

The proposed program will be a 28-month effort incorporating all the following aspects: (1) process variable analysis, (2) analysis of laboratory samples, (3) production of component test samples, and (4) overall economic optimization by computer model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0011, ATOMIC AND MOLECULAR PROCESSES

R.S. Berry, University of Chicago, Graduate School, Dept. of Chemistry, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (CHE79-01166)

This research is in the area of quantum chemistry. Dr. Berry intends to continue a program of research involving the spectroscopic, thermodynamic and dynamic properties of nonrigid clusters, especially to relate nature and degree of nonrigidity to spectral distribution, but also extending to the interpretation of correlated motion in molecules, atoms, and nuclei, and to the interpretation of the nucleation and melting of very small clusters. The major effort in the spectroscopic aspect of this research, the analysis of spectra of nonrigid clusters, will be directed toward high-resolution spectra of real molecules. It is his

intention to predict vibration-rotation spectra from theoretical calculations based on pair interactions, to make phenomenological fits of experimental spectral lines to the patterns predicted by the correlation diagrams, and from these fits, to predict additional lines and interpret the nature and degree of molecular nonrigidity. In addition to PF5, he intends to examine the rare gas halides such as HeI2 and NeI2 that are best known from their laser-induced fluorescence spectra, and the alkali trimers and tetramers, whose potential surfaces are becoming known from theoretical calculations. This research represents a continuation of that currently supported by Foundation grant CHE76-17821.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0012, EXPERIMENTAL AND THEORETICAL STUDIES OF INTRAMOLECULAR AND INTERMOLECULAR DYNAMICS

S.A. Rice, University of Chicago, Graduate School, Dept. of Chemistry, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (DF045720; AFOSR-80-0004)

AF function - reconnaissance, surveillance, communication and other areas require developments in new, stable lasers. Deficiency - there is a requirement for the understanding and analysis of chemical systems with selective reactivity and/or energy exchange. Objectives -investigate aspects of the dynamics of intramolecular and intermolecular energy transfer and related phenomena. Provide both experimental information and theoretical descriptions which will elucidate: (1) primary processes in unimolecular reactions, (2) the pathways of energy transfer in bimolecular encounters and the relationships of these with physical processes, such as quenching of excitation, and chemical reactions, (3) the nature of the reaction products and the energy disposal between them for given initial states of the reactants. How work contributes - unraveling of the many molecular processes which underlie these phenomena will contribute to the store of concepts and information needed for upper atmosphere processes, potential chemical lasers and the generation of chemical intermediates in defined states of excitation.

(1) Examine the rate of intramolecular vibrational relaxation and the pathways for decay of vibrational excitation in the absence of collisions; (2) determine whether intramolecular vibrational relaxation is fast or slow relative to chemical reactions; (3) establish the nature of intramolecular vibrational energy transfer induced by collisions; and (4) determine the influence of initial state selection and coupling between various degrees of freedom on the course and rate of unimolecular reactions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0013, MECHANISMS OF HYDROGEN EMBRITTLEMENT IN METALS AND ALLOYS USED IN NAVAL STRUCTURES

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This research undertakes to clarify the mechanisms by which hydrogen can embrittle metals and alloys, such as those used for naval aircraft and ship structures.

Crack initiation and propagation mechanisms in metal-hydrogen alloys are being investigated over a range of hydrogen contents, temperatures and stress conditions. Standard metallurgical techniques are being used.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0014, STRESS CORROSION CRACKING OF HIGH-STRENGTH ALUMINUM ALLOYS

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AF function - hydrogen embrittlement is a serious problem that causes mechanical property degradation in our most significant aircraft materials, including steels, titanium, aluminum and nickel-base alloys. Opportunity - hydrogen-related phenomena are suspect of playing key roles in the mechanisms of stress corrosion cracking, subcritical crack growth, hot salt corrosion, weld cracking, temper embrittlement, fatigue crack growth, and brittle fracture in general. Objective - this investigation will identify the role played by hydrogen in stress corrosion cracking of high-strength aluminum alloys through brittle film analysis, crack growth studies, hydrogen permeation studies, and hydrogen charging experiments. How work contributes - the various forms of hydrogen-related mechanical property degradation severely restrict the serviceability of important aircraft materials. Basic understanding of the manner by which hydrogen acts to reduce mechanical strength and cause failures is important if we are to minimize and control these forms of attack.

Specific emphasis will be placed on the role of hydrogen in the intergranular stress corrosion cracking of high-purity Al-Zn-Mg ternary alloys (7000-series model). The research will pursue four major issues: the possibility of hydride formation as a brittle film on fracture surfaces, hydrogen diffusion in the grain boundary region ahead of the crack as the rate-limiting step in the cracking process, and control of the diffusion process by modifying the microstructure, correlation of crack velocity with direct measurements of hydrogen diffusion, correlation of hydrogen concentration to ductility loss.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0015, COMBUSTOR FLAME STABILIZATION, FUEL SPRAY IGNITION BY HOT SURFACES AND AIRCRAFT FIRE STABILIZATION

A. Lefebvre, Purdue Research Foundation, *West Lafayette, Indiana* 47907 (DF050030; AFOSR-77-3446)

AF function - advanced air-breathing engines, weapon delivery and defense, transport, aircraft fire safety, vulnerability and survivability. Deficiency - insufficient fundamental understanding of basic processes of ignition and flame stabilization in advanced high-temperature, high-pressure air-breathing combustors, inability to predict propulsion system performance, insufficient understanding of ignition and stability phenomena related to internal and external aircraft fires caused by engine and fuel system damage. Objective - to formulate realistic analytical representations of the mechanisms and processes of fuel spray preignition, ignition by hot surfaces, flashback, blow-off, and flame stabilization by flame-holders, other separated flow regions, and jets. Applications include external fire situations and void space fires, as well as advanced burner concepts, e.g., catalytic, vortex, rapid expansion and premixing/prevaporizing combustors. How work contributes - will provide additional understanding, experimental data and realistic analytical (modeling not now available) of pre-ignition, flashback and blow-off in gas turbine combustors, for ignition of fuel sprays by hot surfaces, for flame-holding by objects such as may occur in structural damage to the airframe, and for flow and flame stability in void space fires. Will aid in performance and flame stabilization improvements, will improve hazard assessment for aircraft fires resulting from accidental or combat damage, and contribute to improved aircraft vulnerability and survivability.

PHASE I - ignition of fuel sprays will be investigated by injection of a fuel spray into an airflow of known properties passing through a heated pipe section. The influence of spray, air flow, and surface properties will be investigated for each fuel considered. Stabilization of fires by large-scale flame-holders is to be investigated in a combustion tunnel initially with V-type and L-type gutters using the water injection method developed by LeFebvre. Exploratory investigations of the flow in partially ventilated enclosures of the type encountered in void-space fire situations will be conducted. PHASE II - flashback and blow-off associated with premixing/prevaporizing combustor systems will be studied. A sudden expansion combustor which models aspects of air-breathing combustors will be studied. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0016, DELAMINATION AND THE EFFECT OF SURFACE INHOMOGENEITIES IN LAMINATED COMPOSITE MATERIALS

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Many naturally occurring and engineered structures can be modeled as laminated composite materials. Examples range from the earth's crust to the currently popular fiber epoxy-matrix composites being developed for aerospace structures. Thus, the prediction of delamination in composite materials has implications ranging from structural integrity to earthquake prediction.

The aim of this research project is to predict the delamination of laminated composite materials, as well as the effect of thin surface-layer inhomogeneities, with particular attention being given to currently important problems. Specific questions being addressed include: (1) the effect of flaw surface conditions and the nature of the bonding on flaw extension, (2) the effect of thin surface-layer inhomogeneities on dynamic surface response, crack propagation, and interface flaw extension, and (3) the difference in flaw extension due to initiation from either a pre-existing flaw or a bonding irregularity.

A set of wave propagation experiments is designed to assess the relative importance of various surface layers upon the dynamic response of a material.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Engineering

3.0017, LASER FLUORESCENCE STUDIES OF MOLECULAR COLLISION DYNAMICS AND SPECTROSCOPY

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Tunable dye laser fluorescence detection will be used for studies in molecular collision dynamics and spectroscopy. Work is continuing on the determination of state-to-state rotationally inelastic cross-sections. A scattering study of j equals 1 LiH on Ar has been completed at one collision energy. Further data will be obtained at other energies with Ar and other scattering partners. Investigations of the effect of incident translational energy on product internal state distributions in reactive collisions are also continuing. An initial study of the Al plus O2 yields AlO plus O has been completed. A number of reactions of alkaline earth atoms will be explored as functions of collision energy. Angular distributions for several reactions as functions of product internal state will also be obtained; additional work will be performed on Ca plus NaCl yields CaCl plus Na, which has already been studied with two effusive reagent beams. In addition, laser fluorescence will be employed in spectroscopic studies. The Al-positive sigma excited-state dipole moment of LiH and NaH will be determined in an electric field-induced level crossing experiment. Electric deflection studies for the determination of ground-state dipole moments are also continuing. Finally, the electronic band spectra of the alkali dimer ions, for which no experimental data exist at present, and of the alkaline earth monocyanides and monohydroxides will be investigated. This research represents a continuation of that currently supported by Foundation grant CHE-7505625.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0018, STUDIES OF ADSORPTION AND CHARGE TRANSFER ON SEMICONDUCTOR SURFACES

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The quantitative characterization of charge transfer in chemisorption on semiconductor surfaces will be continued. The major objectives of the proposed research are: (1) the establishment of the correlation between surface charge transfer activity and atomic composition of the surface; (2) the study of charge transfer employing materials other than ZnO (e.g., CdS); (3) the study of irradiation effects on adsorption and the charge transfer involved in oxygen adsorption on ZnO and CdS will be carried out as a function of surface preparation (ion bombardment, cleavage and heat treatment in UHV) and as a function of surface contamination with impurities potentially active in the charge transfer process such as carbon and photosensitizing dyes. The rate of charge transfer will also be investigated over a broad range of surface potential barriers, oxygen pressure and temperature. An assessment will also be made of charge transfer within a semiconductor and of the mechanism responsible for the thermal activation energy. The atomic composition of the surfaces will be determined with Auger spectroscopy prior to adsorption, at intermediate stages of adsorption. The mechanism of photodesorption and the role of surface impurities active in irradiation-induced desorption will also be investigated. This is a continuation of NSF Grant ENG75-00521.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Engineering

3.0019, MICROSTRUCTURE OF AMORPHOUS AND SEMI-CRYSTALLINE POLYMERS

D.R. Uhlmann, Massachusetts Inst. of Technology, School of Engineering, Dept. of Metallurgical & Materials Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF046980; AFOSR-77-3226)

AF function - advanced aircraft systems will utilize lightweight polymeric and adhesively bonded structural components and composites and impact-resistant transparent canopy materials. Deficiency - although the mechanical and optical properties are determined by processing, the fundamental understanding governing behavior is inadequate. Objective -selected microstructural features of amorphous and semi-crystalline polymers and their relation to processing and mechanical, physical and optical properties will be investigated. How work contributes - this research will help develop the understanding regarding the character of supramolecular structure and the importance of specific morphological features in determining properties which are needed for processing matrix and adhesive resins whose chemistry and microstructure can reproducibly be tailored to specific needs.

The study will explore (1) nodular structures in amorphous thermosetting and thermoplastic polymers; (2) chemical and structural differences between bulk material and near-surface regions in semi-crystalline polymers; (3) crystallization behavior under high thermal gradients and its effect on structure; and (4) differentiation between adjacent reentry folding and switchboard models for the basic structural units in semi-crystalline polymers. In each case a combination of experimental techniques will be used to elucidate the important structural features of the materials and their variations with changes in process conditions. The structural features will in turn be related to the mechanical and optical properties of the materials with specific attention directed to yield and fracture behavior and to transparency at optical frequencies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0020, ENERGY LEVELS OF OXIDES

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AF function - nuclear weapons effects. Deficiency - radar and communication blackout and optical interference following nuclear detonations cannot be accurately predicted. Objective - the objective of this research is to obtain energy levels of lowest-lying states of metal oxides in order to determine their importance in nuclear weapons effects. How research contributes - experimental data for energies of excitation can be used in order to develop a model to calculate the thermochemical properties of all the lanthanide monoxides. These data are then used in USAF codes to predict the importance of these species in a nuclear environment.

Optical-optical double resonance techniques will be used to study the spectra of ytterbium monoxide, and from these experiments electronic state assignments and energy levels will be obtained.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

3.0021, HIGH-TEMPERATURE PROPERTIES OF EUTECTICS, DIRECTIONALLY SOLIDIFIED ALLOYS AND MONOCRYSTALS FOR POTENTIAL ARMY AIRCRAFT ENGINE

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Properly chosen eutectics, directionally solidified alloys or monocrystals may provide the optimum method for making turbine blades and vanes.

Mechanical properties of eutectics and other alloys are influenced by the solidification parameters. Currently, properties are optimized by rapid cooling, directional solidification, solidification as a monocrystal, etc. These methods have limitations and thus experiments are being conducted to improve upon the techniques and also to devise new methods of solidification. Current interest is centered upon experiments involving controlled liquid flows artificially introduced at the liquid-solid interface during solidification.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0022, FEASIBILITY OF DIESEL FUEL MARINE (DFM) AS AN EMERGENCY AIRCRAFT FUEL

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To determine the suitability or adaptability of diesel fuel marine (DFM) or mixtures of DFM and JP-5 for emergency use in gas turbine engine-powered aircraft during shortages of JP-5. This is a continuation of work formerly done under work unit DN789752 which has been terminated.

Evaluate DFM and blends with JP-5 by standard JP-5 specification tests. Determine combustion performance and performance of aircraft fuel pumping and metering equipment. Evaluate compatibility with aircraft materials and with fuel decontamination equipment. Determine limitations on use of DFM. Some of this work is being performed on contract in work unit DN789777.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

3.0023, INTERACTIONS OF VIBRATIONALLY EXCITED MOLECULES WITH SOLID SURFACES 17349-C

P.L. Houston, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Chemistry, *Ithaca, New York* 14850 (DA0G2993; DAAG29-80-K-0020)

To investigate collisions of vibrationally excited gas molecules with well-defined solid surfaces in order to examine surface-induced de-excitations of molecular vibrations and the effect of vibrational excitation on the reaction cross-sections of gas-solid chemical reactions. Relevance - results of this research will have important implications for gaining mechanistic insight into the ignition and burning of propellants as well as for the mechanism of gun barrel erosion.

Vibrational de-excitation will be determined by measuring the decay in fluorescence. Reaction cross-sections will be measured mass spectrometrically.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0024, ALUMINUM NITRIDE CRYSTAL GROWTH

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AF function - microwave circuits are essential elements of Air Force reconnaissance, surveillance, communications and countermeasure systems. The development of improved solid-state microwave circuits requires devices that operate at higher power levels than presently available. Deficiency - one of the major problems in developing high-power microwave devices is finding materials that can withstand the high operating temperatures and that have a sufficiently high thermal conductivity to permit cooling. Another major problem is the lack of suitable, inexpensive heat-sink substrates for the extraction of the heat generated. Objective - the objective of this research is to grow AlN crystals of sufficient size and purity to be utilized as heat-sink substrates for high-power microwave devices. How work contributes - this research could produce AlN crystals that would solve the heat-sink problem.

AlN single crystals will be prepared from AlN powder by sublimation in a sealed single-crystal tungsten crucible and high-purity AlN ceramics will be made by the pellet-drop technique. The physical parameters of the AlN single crystals and ceramics will be determined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0025, STUDIES IN DEFORMATION AND FRACTURE 16361-MS

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The research will include: (1) a study of localized deformation and fracture in polymeric materials, with concentration on modification of existing deformation models to take into account the local structural and compositional factors that govern localized flow; (2) study of the relation of structural factors of polymeric foams to crack propagation in fatigue; and (3) determination of the corrosion-fatigue behavior of metal-matrix composites. Relevance - structural foams are planned for Army applications such as vibrational and shock damping in a wide variety of vehicular structures. The establishment of foam structure and its relation to dynamic mechanical properties of foams is essential to this work. Metal-matrix composites are planned for a variety of structural applications in bridging and helicopters.

Molecular weight and crystallinity determinations in localized deformation regions will assist in establishing new heat transfer parameters and a basis for modification of existing deformation models. Stereological studies of cellular structures in various types and densities of polymeric foams will be used as baselines for determining preferred crack paths in fatigue. The corrosion-fatigue behavior, as expressed by S-N and DA/DN data will be developed for various classes of Al/G and other systems to determine the roles of environment, stress level, and other factors in fatigue crack resistance.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0026, SHEAR BANDS IN FORGED PRODUCTS

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AF function - observations of shear bands have been frequent in conventional titanium alloys used for gas turbine engine compressor blades and aircraft structures, and in nickel alloys used for jet engine components. Opportunity - metalworking processes are designed to produce parts to specified shapes with certain microstructures, and to do so without production of defects which may detract from service performance. These defects run the gamut from internal void formation, inhomogeneous phase distribution and strain localization, to internal and external fracture. Often, process variables such as working speed and lubrication interact with material properties in the generation of these defects. One example of such an interaction may be cited in the occurrence of shear bands (regions of highly localized deformation crossing many grains) in forged products. Objective - this investigation is to document experimentally the occurrence of shear bands in forged products and to validate analytical techniques for their prediction. In addition, the effect of shear bands on subsequent mechanical behavior before and after typical post-forging heat treatments will be established. How work contributes - the results of this program will lead to much needed understanding of effects and control of a common forging defect which is of vital interest to the Air Force.

The research program will be performed over a 3-year period. In the first year, the mechanical properties of the program material will be determined, the applicability of heat transfer and combined heat transfer-deformation models established,

and instability criteria evaluated in a simple deformation mode. During the second year, a simple and a more complex forging will be done to establish the validity of the heat transfer-deformation analysis and instability analysis to simulate more general deformation modes and to determine how these analyses should be used to predict process variables which lead to shear band development. Finally, the third-year program will consist of mechanical testing to determine the effect of shear bands on in-service properties. In view of the ongoing program on the development of a science base for manufacture of a dual property compressor disk of Ti-6Al-2Sn-4Zr-2Mo, this alloy will be utilized. In addition, there is a general move away from the Ti-6Al-4V alloy towards other titanium alloys. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0027, ENVIRONMENTAL IMPLICATIONS OF ALTERNATE FUELS

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To determine the changes in the quality and quantity of pollutants emitted by various blends of potential AF alternate jet fuels when burned in three different combustor types or utilized in various AF fuel-handling systems.

Up to twelve different blends of potential AF alternate jet fuels will be burned in three different combustor types (low-pressure can, high-pressure can, and high-pressure annular) to determine the changes in the quality and quantity of emitted pollutants (NOX, CO, smoke, and UBHC). Certain physical and chemical properties of the fuel blends will also be determined. The work will be accomplished by the AFAPL through multiple contracts with industry. The appropriate AFAPL JONs are as follows: 30480581 (low-pressure can), 30480584 (high-pressure annular), and 30480595 (high-pressure can). A CEEDO/AFAPL technical report will be published for each of the anticipated three contracts to be performed during this program.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

3.0028, FUELS - TECHNICAL SUPPORT

C.R. Martel, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF464140)

Solve problems related to the use of aviation turbine and ramjet fuels in air-breathing propulsion systems. Provide support to operational systems and new systems under development.

Prepare and update fuel specifications as required. Aid in the investigation of field problems where needed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0029, TURBINE ENGINE LUBRICANT RESEARCH

H.A. Smith, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF451270)

Establish basic parameters of turbine engine lubricant degradation from which new and improved methods and guidelines for assessing and defining the performance capability of current and advanced high-temperature lubricants can be made. Correlate the physical and chemical characteristics of wear particles with the mechanisms of wear occurring in turbine engine lubrication systems. Investigate and develop monitoring techniques for lubricant systems. Investigate foaming characteristics of turbine lubricants and the effects of fine filtration on lubricant foaming as well as other lubricant properties.

Develop and utilize analytical methods of analyses for correlating laboratory evaluations and full-scale engine experience. Study wear mechanisms through ferrography and other lube wear metal analysis techniques satisfactory for field use.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0030, ESTUARINE TRACE ELEMENTS AND THEIR APPLICATION IN WATER POLLUTION TRACING

W.D. Loveland, Oregon State Higher Education System, Oregon State University, School of Science, Dept. of Chemistry, *126 Agricultural Hall, Corvallis, Oregon* 97331 (R/CP-14)

OBJECTIVE: We propose to develop a new, stable activable tracer technology for use in tracing fluid-bound pollutants and organic chemicals in the marine environment. Such a technology would be cheaper, faster, and more sensitive than conventional radiotracers and fluorescent dyes. It would allow simultaneous tracing of several pollutant sources over large distances and long times, without danger to the environment. The following specific objectives are proposed: (1) to develop and test in the laboratory the use of rare-earth stable activable tracers in marine waters; (2) to field test these tracers in Yaquina Bay, Oregon; (3) to map the trace element concentrations in the sediments and waters of Yaquina Bay; and (4) to establish trace element fingerprints for pollutant discharges into the Bay.

ANTICIPATED BENEFITS: Coastal zone water resource managers who have employed radiotracers and fluorescent dye tracers will have a tool that is cheaper, faster, and more sensitive. Affected water resource management areas include (1) flow velocity of natural water - examples include ground water, rivers, and estuaries; (2) flow rates in open and closed conduits; (3) soil erosion by wind, rain, and water flow; (4) aquifer properties, such as porosity, transmissivity, and permeability; (5) the spatial and temporal distribution and dispersion of fluid-bound waste materials; (6) nature of turbulence in fluids; and (7) detection of fluid losses from pipes and conduits. In addition, there are several new measurements that are possible only with the proposed new technology: (1) studies of fluid-bound pollutant transport where there is more than one source of material; (2) long-term studies where dye tracers can photochemically decay and radiotracers must be dangerously concentrated.

IDENTIFIED BENEFITS TO DATE: (1) Tracers, involving anionic DTPA complexes of the rare earths, have been made to trace fluid-bound pollutants in marine waters. Methods of dispersal, collection (via co-precipitation) and analysis have been developed. These tracers were shown to be stable and conservative at least three weeks in estuarine waters in contact with sediments. (2) A field study involving the measurement of the flushing time of an estuarine marina is underway. (3) Organodysprosium complexes have been synthesized and look promising as tracers for PCBs and DDT analogs. (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

3.0031, CALORIMETRIC STUDY OF GRAPHITE INTERCALATION COMPOUNDS

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This research will be a study of the thermal behavior of graphite intercalation compounds using differential scanning calorimetry (DSC). In particular, it has been found that order-disorder transformations associated with ordering of the intercalate species strongly affect the thermal stability. In order to apply graphite intercalation compounds at various temperatures, these transitions need to be understood. Thermodynamic and kinetic information is essential. The DSC technique can be used to determine the enthalpy, entropy and activation energies of inter- and intralayer order-disorder transformations occurring in graphite intercalation compounds. In this work DSC will be used to detect the presence of phase transformations in compounds of intercalate species such as bromine, cesium, rubidium and potassium. Th thermodynamics and kinetics of the transformations and their dependence on the stage and intercalate species will be investigated.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0032, EFFECTS OF DEFORMATION MODE AND MICROSTRUCTURE ON THE FRACTURE-RELATED PROBABILITIES OF TITANIUM ALLOYS
J.C. Williams, Carnegie Mellon University, Carnegie Inst. of Technology, Dept. of Metallurgy & Materials Science, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (DF057040; AFOSR-80-0044)

AF function - titanium and its alloys have been of considerable interest to the Air Force because of very favorable strength-to-weight characteristics at temperatures from cryogenic up to 1000 degrees F. Opportunity - potential applications for skins, structural and engine components of high-performance aircraft, cryogenic fuel storage tanks for missiles, and tubing for transporting corrosive fuels all emphasize the available materials roles for titanium alloys. Objective - this research will provide an improved understanding of the role of microstructure, alloy composition, and loading history on the elevated temperature fatigue and creep performance of titanium alloys. How work contributes - the low-cycle fatigue performance and elevated temperature fatigue and creep crack growth rates will be investigated as a function of microstructure in two classes of alloys: (1) existing high-temperature titanium alloys with potential for application, such as Ti-6242S, and (2) the newly developed aluminides based on TiAl and Ti2Al.

The program is separated into three parallel, concurrent tasks. The first deals with the effect of microstructure and character (strain localization) on LCF life. The second deals with the relationship between microstructure and slip character on the rate of fatigue crack growth. The third deals with the effect of alloy composition and heat treatment on the microstructure and properties of a range of alloys of the Ti-Al-Nb class based on the Ti-aluminides.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0033, A PROGRAM LEADING TO SPECIFICATIONS FOR AVIATION TURBINE FUEL PRODUCED FROM WHOLE CRUDE SHALE OIL
A. Schneider, Suntech Inc., *P.O. Box 1135, Marcus Hook, Pennsylvania* 19061 (DF462710; F33615-78-C-2024)

The objectives of this program are: (1) to optimize new procedures for the efficient and economic processing of whole crude shale oil into high yields of military fuels while maximizing the yield of aviation turbine fuel; and (2) to determine the trade-offs between jet fuel yield, jet fuel properties and processing costs.

The proposed research program will be a 24-month effort leading to an optimized process design incorporating all the following aspects: (1) process variable analysis, (2) analysis of laboratory samples, (3) production of component test samples, and (4) overall economic optimization by computer model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0034, METAL LAMINATE DEVELOPMENT FOR STRUCTURES
O.H. Cook, Advanced Technology Center Inc., *P.O. Box 6144, Dallas, Texas* 75222 (DN890148; N00019-78-C-0491)

Develop metal laminates used for critical structural parts, but not at the expense of strength, corrosion resistance or stress-corrosion resistance.

Explore the metal/metal laminates utilizing recently developed alloys of titanium and steel.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0035, REACTIONS AND ELECTROCHEMICAL KINETICS OF NEWLY GENERATED METAL SURFACES
T.R. Beck, Flow Industries Inc., *21414 68th Ave. S., Kent, Washington* 98031 (DF035320; F44620-72-C-0070)

Air Force flight vehicles must withstand increasingly complex environmental and operational regimes. Fundamental knowledge of the mechanism of fatigue and fracture of flight structures is required. This research is directed to obtain knowledge of electrochemical mechanisms that operate in fatigue cracks and stress-corrosion in flight structures. It includes the determination of kinetic parameters for newly generated surfaces of titanium, aluminum and other metals that can be put into a quantitative mass transport-kinetic model to completely describe the electrochemistry in cracks. A new experimental technique employing corroding metal specimens of restricted geometry with the application of step potentials and transient current measurements will be used to yield information on conductivity, thickness, and kinetics of salt films. Other transition metals will be studied using these techniques. Models will be developed for nucleation and growth of salt, oxide films, and dissolution. The electrochemical mass-transport-kinetic model for stress-corrosion of titanium using new kinetic data will be reformulated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0036, ENERGY CONVERSION - SEMICONDUCTOR ELECTRODES IN OPTICAL ENERGY CONVERSION
A.B. Ellis, University of Wisconsin, Madison Campus, School of Chemistry, Dept. of Chemistry, *Agriculture Hall, Madison, Wisconsin* (DN875507; N00014-78-C-0633)

The Navy and Marine Corps rely on small portable power sources and electronic devices for a variety of fleet applications such as communications. Electrochemical processes involved at semiconductor-electrolyte interfaces are finding applications in optical energy conversion systems such as photoelectrochemical cells and in chemical sensors; also a fundamental understanding of interfacial energy transfer mechanisms is important to semiconductor passivation (anodization) and the long-term chemical stability of electronic materials.

To investigate the photoluminescent properties of various semiconductor surfaces in contact with electrolytes in a photoelectrochemical cell configuration. Decay processes involving multiple excited states and interfacial energy transfer mechanisms will be investigated for semiconducting materials that include cadmium sulfide doped with tellurium and silver.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, AUTOMATIC TARGET HANDOFF CORRELATOR VIDEO DATA SUPPORT
Unknown, Boeing Co., *220 Wynn Dr., P.O. Box 1470, Huntsville, Alabama* 35807 (DA0G3430; DAAH01-80-R-0652)

To perform testing, data reduction and reporting of TV and IR technology hardware for determining quantization effects on target handoff system for missile fire control with applications to Hell-fire, advanced attack helicopter, and advanced scout helicopter.

Perform recording of video scenes from GFE television and infrared sensors at Redstone Arsenal test ranges. This includes connecting and operating electronic and electrooptical equipment in accordance with an Army test plan and maintenance and calibration of electronic test equipment.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Guidance & Control Directorate

4.0002, REFURBISHMENT AND ENGINEERING SUPPORT OF RECOVERED PAYLOAD RECOVERY SYSTEMS
E. Allen, Space Data Corp., *1333 W. 21st St., Tempe, Arizona* 85282 (DF249840; F19628-78-C-0015)

AF function - recovery of aerospace payloads. Deficiency - economical recovery of small-diameter sounding rocket payloads. Objective - to provide the AF with reliable, accurate, and low-cost recovery systems for small sounding rocket payloads. How research contributes - the research will result in an inven-

tory of reliable recovery systems that will enable scientific payloads to be recovered, refurbished and re-flown, thereby reducing the per-mission cost of sounding rocket research projects.

The AF intends to contract for the refurbishment of recovered recovery systems. It is intended that four GFE systems per year will require refurbishment in each of three years.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0003, SILICON CARBIDE WHISKER-ALUMINUM MMC STRUCTURAL FABRICATION AND CHARACTERIZATION

E.J. Levin, DWA Composites Specialist Inc., *Chatsworth, California* 91311 (DF145840; F33615-80-C-3231)

The continued need to improve the performance of Air Force flight vehicles places a premium on design of efficient, reliable airframe structural configurations. Metal matrix composites (MMCs) provide one approach to improved airframes through application of advanced materials systems which permit reduction of structural weight fractions, increased stiffness within a prescribed structural envelope, and/or acceptance of a more severe operating environment. One detrimental factor which hinders development of necessary MMC technology is the projected high cost of materials which carries over to the finished hardware. The objective of this program is to assess the ability of a new silicon carbide Whisker-aluminum alloy (SiC Whisker/Al) consolidation process to economically produce viable SiC Whisker/Al composite sheets for structural panel applications. Cost-competitive MMCs will provide a key technology cornerstone for future design of more efficient airframes for advanced military flight vehicles.

The technical and economic potential of a new SiC Whisker/Al powder consolidation process to produce cost-competitive MMC structural hardware will be assessed by a three-task program to (1) produce and characterize a series of SiC Whisker randomly reinforced aluminum alloy sheet samples, (2) develop tooling and processes for fabricating simple heat-stiffened panels and evaluate effects of various heat treatments on selected composite material systems, and (3) fabricate and characterize SiC Whisker/Al heat-stiffened structural panels.

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0004, AUTOMATED AIDS TO ISD FUNCTIONS

H.D. Kribs, Instructional Science & Development Inc., *5059 Newport Ave., San Diego, California* 92107 (DN994035; N61339-79-C-0104)

Procure a contract to provide materials, suggestions and specifications for the development of system functions which will improve and expand the utility of a developing experimental system for aiding the applications of the ISD process to naval aircrew training.

Recommendations and specifications for incorporating new features and applications into the prototype system and their cost-benefit evaluations and priorities will be based on such things as (a) information and materials available from literature, expert opinion and ongoing projects; (b) logical analyses of step-by-step operations required for ISD activities performed in a traditional manner versus those performed with new system applications or features; (c) consideration of the ease of implementing the new application feature; (d) the configuration and constraints of the developing system; and (e) efforts to actually apply the system.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Human Factors Lab.

4.0005, LASERS - ATOMIC CROSS-SECTIONS

J.R. Peterson, S R I International, Physical Sciences Division, *333 Ravenswood Ave., Menlo Park, California* 94025 (DN023325; N00014-76-C-0118)

The cross-sections for various atomic processes such as penning ionizations, excitation transfer, etc., are being measured for collisions between metastable rare-gas atoms and various targets. These are important to the Navy since they occur in various lasers containing rare gases and because similar processes occur between atmospheric species.

The metastable beam composition resulting from charge transfer collision of Ne(positive) with Cs will be determined. Scattering experiments using purified metastable beams and various atomic and molecular targets will be performed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0006, NEW APPROACHES TO OPTICAL SYSTEMS FOR INERTIAL ROTATION SENSING

M. Chodorow, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DF044420; AFOSR-76-3070)

AF function - navigation, guidance and control of aircraft, spacecraft and missiles require sensors of angular rotation rate in inertial space. However, conventional gyroscopic sensors pose cost and adaptation problems. Opportunity - although the coming use of ring lasers in strap-down systems will offer considerable advantages, proper use of new integrated optics and integrated circuit advances will minimize the cost and maximize the adaptability and availability of these new sensors which allow the direct measurement of absolute inertial rotation rate without requiring comparison with other standards for calibration. Objective - the intrinsic limitations of ring lasers are to be avoided by new approaches which have the potential for integrated optics implementation and high performance cost ratio. How work contributes - this research should lead to devices which are free from lock-in and bias effects encountered in conventional laser gyros, have high sensitivity and accuracy and allow ready adaptation to specific requirements such as size reduction, cost decrease or sensitivity increase and adaptation to a specific environment and geometry.

The new approaches are based on the Sagnac effect like the ring laser. However, in contrast to the latter, the laser source is outside the ring. Pulse transmission and amplification in a multi-turn loop is used, which leads to a frequency read-out signal equivalent to that of a conventional ring laser. Optical fiber waveguides appear promising for constructing the sensing loops, offering unique advantages in fabrication and application. Calculations have indicated sensitivities in measurement down to very low rotation rates suitable for future navigation systems. This phase of the investigation continues experiments with components of what is referred to as the Active Re-entrant Sagnac System (ARS) using a CW He-Ne laser and a passive multiple-fiber loop, then recirculation and sampling and later active recirculating of pulses from a solid-state laser.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0007, RELATIVISTIC MICROWAVE MAGNETRONS

S.A. Self, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (ENG78-24569)

This program is concerned with research on the generation of microwave energy by relativistic electron beams. This work is based on the use of classical magnetron designs modified to accomodate the energetic electrons. Use of a thermionic oxide cathode rather than a field emission cathode is being explored and control of transient model behavior during pulse onset is being emphasized. The objective of the research is to provide gigawatt power level pulses that contain a total energy in the kilowatt range.

This is a continuation of research previously supported under NSF grant ENG-7804208.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering

4.0008, RADAR DETECTION OF SMALL SEA-TARGETS

S. Weisbrod, Teledyne Micronetics, *7155 Mission Gorge Rd., San Diego, California* 92120 (DN890236; N00019-79-C-0625)

To investigate the possibility of using polarization discrimination techniques for detecting small sea-targets from airborne platforms.

The approach will be to investigate optimum techniques for target discrimination by making use of the complete scattering

matrix derived from radar backscatter information. This scattering matrix provides information which could be used to plot data in a five-dimensional hyperspace. Emphasis will be placed on evaluating this information to determine if a unique description between targets and sea-clutter can be achieved and, if so, can the data be displayed in an easily comprehensible manner.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0009, ADVANCED HYPERSONIC WEDGE NOZZLE TECHNOLOGY

D. Hook, Thompson Ramo Wooldridge Inc., *1 Space Park, Redondo Beach, California* 90278 (DN980273)

To evaluate advanced nozzle concepts for Navy applications.

Evaluate hypersonic wedge nozzle concepts. Study optimum mixing rates, flow compositions, flow expansion rates, heat loss, secondary flow, and flow-field properties from the standpoint of laser efficiency, lasing zone-length, and pressure recovery. Hypersonic wedge nozzles offer the promise of improved performance, lower fuel utilization and cheaper production (as a result of their simple design) for CW Hf/Df lasers for helicopter applications.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0010, DEVELOPMENT OF TRANSONIC COMPRESSOR MODEL

R.P. Shreeve, U.S. Dept. of Defense, Navy, Naval Postgraduate School, *Monterey, California* 93940 (DN898080)

To develop a small transonic axial air compressor model and establish methods for measuring the performance and flow behavior.

Design, build and test a transonic compressor and compressor test rig, and perform measurements of overall performance and internal flow behavior.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0011, APPLICATIONS OF RAYLEIGH SCATTERING TO TURBULENT FLOWS WITH HEAT TRANSFER AND COMBUSTION

L. Talbot, University of California, Berkeley Campus, School of Engineering, Dept. of Mechanical Engineering, *Berkeley, California* 94720 (DF038830; F49620-80-C-0065)

AF function - advanced air-breathing engine technology. Deficiency inadequate understanding of the influence of turbulence in practical combustion devices, and lack of satisfactory measurement and analytical techniques for determining the effects of turbulence on reacting flows. Objective - to investigate the influence of both small-scale and large-scale coherent-structure turbulence on the propagation of flame fronts, and the interaction between turbulence and flame propagation. To develop the techniques of Rayleigh scattering and laser Doppler velocimetry as reliable diagnostics for the study of reacting flows. To obtain experimental data on flame propagation in turbulent flows which can be employed to improve the numerical modeling of such flows. How work contributes - results will provide additional information on the effects of turbulence on flame propagation which will add to the understanding of such flows and which can be used in the evaluation of numerical models of turbulent reacting flows, so as to improve the predictive capability of such models in the design of combustion devices.

In this program a rod-stabilized two-dimensional flame will be maintained in a coaxial methane-air jet issuing from a plenum chamber. To study the effect of large-scale turbulent structures on the flame, a vortex street will be produced by a cylinder upstream of the flame. The interaction of this vortex street with the flame front will be measured by laser Rayleigh scattering and velocimetry. Computer-controlled phase-locked averaging techniques will be used to map the changes in density and velocity with time of the flame front and the flow-field ahead of and behind it. In the study of small-scale turbulence effects, the vortex street will be replaced by grid-generated turbulence. Measurements will also include two-point correlations of density and velocity, and single-point cross-correlations of velocity and density-velocity. Vortex street results will be compared with flame-vortex computations using the method of vortex dynamics, and the grid turbulence results will be compared with time-averaged models of turbulent flame propagation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0012, DESIGN AND IMPLEMENTATION OF MULTI-INPUT ADAPTIVE SIGNAL EXTRACTORS

W.A. Gardner, University of California, Davis Campus, School of Engineering, Dept. of Electrical Engineering, *Davis, California* 95616 (DF055250; AFOSR-80-0189)

AF function - digital signal processing for such applications as radar, telemetry, and communications. Deficiency - increasingly stringent requirements in communications, reconnaissance and flight control, among others, create corresponding demands in the area of signal processing. The high costs in size, weight and power have to be reduced, while speed and accuracy of the processors have to be improved. Objective - improvements in signal extraction performance, in the cost of implementation, and in speed of operation of digital filters. How work contributes - the results of this research could be directly usable in the design of future Air Force electronic equipment.

The concept of adaptive noise cancellation will be generalized to the area of adaptive signal extraction. The method depends on having two or more filter stages with appropriate feedback and variable or adaptive gains. Residue arithmetic will be exploited for speed and accuracy.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0013, FEASIBILITY STUDY OF DEVICE SYNTHESIS OF NONLINEAR FILTERS

R.S. Bucy, University of Southern California, School of Engineering, Dept. of Electrical Engineering, *3551 University Ave., Los Angeles, California* 90007 (DF042580; F44620-76-C-0085)

AF function - Air Force systems for communications, signal processing, navigation, and control need efficient and reliable methods for the separation of the signal from disturbance and noise. In practical signal processing systems, nonlinearity is the rule rather than the exception, and improved signal filtering, estimation, and tracking methods for such systems are definitely needed. Opportunity -means for filtering, estimation, and identification of such signals are mostly based on assumptions of linearity of the system model and Gaussian statistics of stochastic disturbances which frequently lead to inaccurate and undesirable behavior. Objective - this research will study methods for realizing a general nonlinear filter in real-time by all-digital schemes, by hybrid optical-digital schemes, and by all-optical schemes. How work contributes - this effort advances filters for use in command and control systems.

The digital approach will entail investigating absolute phase determination, determining the effect of amplitude uncertainties on the phase estimate, and generating three-dimensional perspective plots of the probability density. In the hybrid approach, the accuracy of the optically computed two-dimensional convolution will be measured, the software will be completed for closure of the filter loop, and the phase estimates of the hybrid system will be compared to those of the all-digital systems. Nonlinear optical devices will be investigated for possible realizations of an all-optical filter.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0014, STUDIES OF OPTICAL-BEAM PHASE-CONJUGATION BY NONLINEAR REFRACTION

R.W. Hellwarth, University of Southern California, School of Engineering, Dept. of Electrical Engineering, *3551 University Ave., Los Angeles, California* 90007 (DF051200; AFOSR-78-3479)

AF function - the University of Southern California has proposed a concept that could have tremendous impact on adaptive optics approaches to Air Force laser systems. These currently involve scanning detectors, interferometers, computers, servosystems and deformable mirrors. All of this hardware

could be replaced by a nonlinear element at low power if the nonlinear refractive idea succeeds. Opportunity - nonlinear refraction may be able to generate an output optical beam which has a conjugate phase from that of the input beam and the same frequency as the input beam. The important point is that if a laser beam is propagated through an atmosphere and reflected back to the receiver, then it will be subjected to an aberration by the optical path that it traversed. If this aberrated return is used as the signal into the nonlinear refractor, the refracted signal would be the phase conjugate of the aberration. This could be injected into a high-power laser and phase-locked so that the laser generates a beam at high power with conjugate phase of the aberrations in the optical path. Objective - the objective of this research is to explore the potential of four-wave mixing (via nonlinear refraction) for producing time-reversed replicas, or phase-conjugates, of optical beams. Contribution - the work provides an alternative to the adaptive optics approach to correcting distortions.

Studies will be conducted on phase-conjugation via nonlinear interactions in an optical waveguide. The dependence of phase-conjugation characteristics on waveguide and beam parameters and choice of nonlinear medium will be examined. Resonantly enhanced phase conjugation with fast (sub-nanosecond) response time utilizing pulsed dye lasers will be investigated. In addition, continuous wave phase-conjugation in slow-response systems will be studied.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0015, TURBINE ROTOR-STATOR AERODYNAMIC INTERACTION

R. Dring, United Technologies Corp., United Technologies Research Center, *400 Main St., East Hartford, Connecticut* 06108 (DF464700; F33615-80-C-2008)

Develop a rational aerodynamic basis for setting turbine rotor-stator axial clearance.

Determine by detailed measurements in a large-scale rotating rig the degree to which rotor-stator aerodynamic interaction influences the flow-field and the stage performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0016, PROPERTIES OF LIQUIDS AND THEIR PHASE TRANSITIONS

R.E. Apfel, Yale University, School of Engineering, Dept. of Engineering & Applied Science, *206 Elm, New Haven, Connecticut* 06520 (DN223158; N00014-76-C-0527)

It is the objective of this research to study metastable liquids and their phase transitions; this includes a detailed investigation of cavitation. Results of this research should aid the Navy's efforts in reduction of noise from propellers and around sonar domes due to cavitation, and increase our understanding of heat-transfer liquids.

The ability to isolate droplets of metastable liquids in an inert host by acoustic levitation provides a means to study phase transition phenomena such as the boiling, freezing and cavitation of superheated, supercooled, and overexpanded liquids, respectively. Measurements of basic properties such as density, adiabatic compressibility, tensile strength, and sound speed are made on liquids in their metastable state. Work on liquid interfacial properties is based on surface wave-generation on levitated drops.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0017, CRITICAL REVIEW OF RECENT RUSSIAN SCIENTIFIC LITERATURE ON FLOW SEPARATION

P.K. Chang, Catholic University of America, School of Engineering & Architecture, Dept. of Civil & Mechanical Engineering, *620 Michigan Ave. N.E., Washington, District of Columbia* 20017 (DF052660; AFOSR-78-3636)

AF function - advanced aerospace vehicles. Deficiency lack of basic knowledge about various aspects of flow separation on general flight vehicle configurations across the speed regime. Objective - to evaluate recent Russian contributions to the field of flow separation and to disseminate this information to the US scientific community. How work contributes - by evaluating the original Russian contributions in the field of flow separation in light of research underway in the west and also by providing a means to disseminate the information, this work will help advance the state of knowledge, help eliminate unnecessary duplication of effort, and provide a firmer foundation for continuing research.

A critical review will be made of the most significant of the 300 recent Russian papers referenced in 'New Results of Separated Flow Studies,' NASA TTF 117, 130, as well as two books in the process of being translated, 'Gradient and Separated Flows' (1976), edited by S.S. Kutateladze, and 'Gas Dynamics of Near Wake' (1976), by A.I. Shvets and I.T. Shvets. These references will be evaluated in light of approaches followed and results obtained by western researchers working in related areas.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0018, OPTICAL MICROCIRCUITRY

W.K. Burns, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN120207)

OJECTIVES: (1) To investigate acoustooptic and electrooptic processes in optical waveguides. (2) To utilize these effects to fabricate optical circuits for use as terminals. (3) To develop signal processors using integrated optical technology. (4) To investigate possible thin film-optical fiber couplers. (5) To determine the causes of thin film-light scattering and to investigate dielectric waveguide formation. The Navy has a continuing need for optical devices and systems with emphasis on efficiency, size, weight and versatility. These characteristics are features of microoptics.

METHODS: (1) Using sputtering and indiffusion techniques, study the formation of optical waveguides and construct waveguide structures such as channel waveguide couplers, overlay interconnects and model lift-off stuctures. (2) Demonstrate active waveguide devices in indiffused ferroelectrics and on silicon substrates. (3) With surface acoustic waves, study acoustooptic interactions, perform spectrum analysis and fabricate optical methods of tapping acoustic signal processors. (4) Study polarization characteristics of light transmitted in fibers and integrated optical device performance when two polarizations are present.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0019, ELECTRONIC STATE OF DEEP-LEVEL DEFECTS IN SEMICONDUCTORS

L.A. Hemstreet, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680408)

Deep-level defects in semiconductor materials, however produced, have a great effect on the electronic properties of devices. An understanding of the properties of such defects is therefore essential to insure proper design and performance of a broad spectrum of electronic and optoelectronic systems employed by the Navy. The objective of this program is to conduct a systematic theoretical study of various classes of deep-level defects in such semiconductor materials as silicon, gallium arsenide, and indium phosphide, and to correlate the behavior of such defects with the local bonding properties of the defect-solid system.

The host solid will be represented by a large cluster of atoms, and realistic self-consistent calculations of the electronic properties associated with various impurities/lattice defects in the host cluster will be calculated using multiple scattering theory.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0020, ELECTRONIC DEVICES & CIRCUITS FOR USE IN RADIATION ENVIRONMENTS

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The Navy has a continuing need for high-density, high-performance semiconductor integrated circuits which can function reliably in satellite, missile, avionic, and ship systems exposed to severe nuclear radiation environments. The objective of the program is to determine fabrication processes by which to build near-ideal insulator/GaAs interfaces for MIS transistor gate and passivation regions.

Gallium arsenide, indium phosphide, as well as silicon-based devices, will be pursued for advanced, high-speed technologies. In-house experimental process research will be performed to fabricate ultra-high-speed logic devices, especially MIS type. Insulator/semiconductor interface characterization will be performed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0021, NON-DESTRUCTIVE TESTING USING NUETRONS

B.B. Rath, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980316)

This program will systematically characterize the role of strain, strain rate and temperature on the nucleation and growth of voids in superplastic alloys. Superplastic alloys are of importance to Navy structures and are currently utilized in forming and joining of critical components of naval aircrafts. The voids formed during superplastic forming could significantly degrade the strength and service life of these materials. This program will utilize a new NDE method to characterize defects from the scattering behavior of long-wavelength neutrons.

During the first phase, a model alloy system (Zn-22 Al eutectoid) will be subjected to varying total strains at predetermined strain rates (10-3S-1 to 10-1S-1) at various temperatures. The void size, shape and distribution will be evaluated from small-angle neutron scattering (SANS) data and the results will be correlated with those from transmission and scanning microscopy and microdensitometry. For selected cases, defects in alloys and ceramics currently under investigation by other ONR contractors will be analyzed by SANS.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0022, PHOTOSTRUCTURAL PROPERTIES OF SEMICONDUCTORS

P.C. Taylor, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980024)

To investigate the structural properties of disordered semiconductors and to characterize and understand the nature of optically induced structural changes (photo-structural effects) in disordered semiconductors. Such information is necessary to evaluate the potential usefulness of these materials as optical and electrooptical components.

The structural and photo-structural properties of crystalline disordered semiconductors are investigated by use of several spectroscopic and resonant techniques including infrared, far infrared, and sub-millimeter wave spectroscopy, microwave dielectric loss measurements, Raman spectroscopy, nuclear magnetic resonance (NMR) and nuclear quadrupole resonance (NQR). The results are used for testing current theories for disordered and crystalline semiconductors and for inventing new devices which utilize the unique properties of these solids.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0023, SURFACE ACOUSTIC WAVES IN LAYERED MEDIA

J.F. Weller, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680042)

To characterize surface acoustic wave (SAW) propagation in layered media and to demonstrate layered SAW devices. OBJECTIVES: (a) Characterize SAW properties in selected layered structures. (b) Design, fabricate and evaluate SAW waveguide devices. (c) Develop beam compression techniques for coupling into SAW guides. (d) Generate and characterize new ways of dispersion compensation in SAW metal guides. The Navy has a continuing need for these electronic devices that emphasize efficiency, size and versatility.

SAW devices and structures will be fabricated using sputtered and evaporated amorphous and diffused metal films on piezoelectric substrates. Using microwave and optical probe techniques, SAW propagation properties will be determined for planar and waveguide structures. Planar and waveguide devices such as phase shifters, switches, convolvers, and 3-dB couplers will be designed, fabricated and evaluated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0024, MILLIMETER-WAVE INTEGRATED CIRCUITS

B.E. Spielman, U.S. Dept. of Defense, Navy, Naval Research Lab., Electronics Technology Div., *Washington, District of Columbia* 20375 (DN080067)

To investigate new and useful classes of planar transmission media, resonator circuits, and associated techniques for interfacing these structures with solid-state devices to provide millimeter-wave and microwave components (e.g., oscillators, amplifiers, harmonic converters) for the frequency range from about 10-120 GHz. Transmission and resonator media must be investigated to define those having characteristics which are more ideally suited to applications in EW, radar, communications, and radio astronomy at mm wavelengths.

Theoretical investigation, with experimental studies, of propagation and energy storage phenomena for various media in the range from 10-120 GHz, including the development of analytical methods suitable for study of specialized electromagnetic phenomena. Scaled models will be appropriately employed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0025, ANALYSIS OF ADVANCED SIMULATOR FOR PILOT TRAINING

J. Hadjilogiou, Florida Inst. of Technology, School of Science & Engineering, Dept. of Electrical Engineering, *Country Club Rd., Melbourne, Florida* 32901 (DF057850; AFOSR-80-0120)

AF function - given the danger and expense involved in training aircrew combat skills during actual flight, more and more Air Force pilot training is being accomplished by means of flight simulators. The ASPT system at HRL is dedicated to the development and experimental testing of new training procedures that can be accomplished with flight simulators. Deficiency - a tremendous amount of down-time of the existing ASPT system, which obviously interferes with its usefulness in doing controlled, timed experiments on the efficiency and effectiveness of various training procedures. Objective - to implement and test two of the recommendations made during the system hardware analyses for the advanced simulator for pilot training (ASPT) general purpose computer equipment. How research contributes - this research will investigate possible ways to improve the ASPT simulator at HRL/OT. Since the ASPT system is vital to the development of new and more effective pilot training procedures, this research contributes to RO's 1.2 and 1.4 of Task 2313.

Dr. Hadjilogiou will first attempt to improve the distributive processor system of the basic configuration of the ASPT by dedicating a host 32/75 computer into the system, which will act as a backup control processing unit and as a host computer for the terminal support system. He will then develop an external monitoring system to aid in both debugging procedures and the design of new systems. Finally, he will develop and test custom microprograms which he predicts will result in a 16-to-1 performance improvement factor in the overall ASPT system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0026, ENERGY CONVERSION - NON-IDEAL PLASMA STUDY

H.E. Wilhem, State University System of Florida, University of Florida, School of Engineering, Dept. of Engineering Sciences, *220 Black Hall, Gainesville, Florida* 32611 (DN975153; N00014-79-C-0073)

This study will provide a method to calculate the plasma electrical conductivity of high-temperature (50,000 degrees K) and high-pressure (10 atm.) of explosively produced plasmas that will be used in weapon MHD pulsed power supplies.

The contractor will develop a quantum statistical theory describing the composition of plasmas characteristic of those produced from explosive drivers. From this theory, a method for calculating the electrical conductivity will be developed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0027, VIRTUAL IMAGE DISPLAY SYSTEM

G. Derderian, U.S. Dept. of Defense, Navy, Naval Training Equipment Center, Advanced Simulation Concepts Lab., *Orlando, Florida* 32813 (DN794008)

This virtual image display system will be an efficient, lightweight compact, low-cost virtual image device which is needed for synthetic flight trainers and tank drive simulators.

The virtual image display system will contain a combination of optical elements that convert a real image, such as a television tube, into a virtual image, such that the scenery appears to be at the real-world distances.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Advanced Simulation Concepts Lab.

4.0028, VORBIX AUGMENTATION DEVELOPMENT

R.S. Reilly, United Technologies Corp., Government Products Division, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DN796807; N0019-76-C-0553)

Evaluate mixed-flow augmentation improvements derived from a unique vortex burning and mixing (VORBIX) concept. Specific goals include increased combustion efficiency (better than 90%) over a complete A/B fuel schedule, improvement in A/B stability, continuous A/B fuel flow modulation and significant length-reduction potential.

Design and fabricate a full-scale, flight-type VORBIX augmentor followed by instrumentation and operational check-out on a F401 test vehicle. Contingent on successful sea-level test results, the experimental vehicle will be evaluated throughout a typical flight envelope in a NAPTC test cell with emphasis in the upper left hand corner.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

4.0029, STUDIES OF SOME BASIC PROBLEMS RELATED TO SATELLITE ANTENNA SYSTEMS

S.W. Lee, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *106 Engineering Hall, Urbana, Illinois* 61801 (DF049270; AFOSR-77-3375)

AF function - a major component of a communications satellite is its antenna. It has to meet stringent specifications in its beam position, gain, side-lobes, polarization and bandwidth. Deficiency - the two most commonly used satellite antennas are the reflector antenna and the waveguide lens antenna. An incomplete procedure for their design prevents an accurate theoretical prediction of the antenna performance necessary for an optimal design. Objective - to eliminate some of the missing links in the design theory of satellite antennas. How work contributes - provides new methods applicable to design by solving related yet unsolved theoretical problems in electromagnetic theory.

1. Investigate the mutual coupling effects in a lens antenna, utilizing generalizations of infinite planar array diffraction and reflection analyses. 2. Explore novel and numerically efficient methods for calculating the secondary patterns of reflector and subreflector antennas.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0030, DIGITAL ELECTRONIC CONTROL SYSTEM RELIABILITY (FULL AUTHORITY, FAULT-TOLERANT EEC)

R. Boyer, General Motors Corp., Detroit Diesel Allison Division, *4700 W. 10th St., Indianapolis, Indiana* 46206 (DF463370; F33615-79-C-2002)

To evolve design guidance with respect to one facet of the reliability/availability/integrity issue associated with the future development of digital electronic engine control systems - that of providing for very high reliability through the use of redundancy, fault-tolerance, tailored to the needs of variable cycle engine control and optimized with respect to the reliability of the system (and of its components) and to cost-of-ownership.

Employ the services of two contractors - one skilled in the synthesis of very-high-reliability, fault-tolerant digital computer systems, and the other skilled in the synthesis of control systems for the engine of high-performance military combat aircraft. The work requires that they work together closely in a program of study and analysis to produce design guidance needed for the future development of full-authority, fault-tolerant (digital) electronic engine control systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0031, ADVANCED ENGINE CONTROL/DIAGNOSTICS INTEGRATION AND DEMONSTRATION (BADEC)

R. McLain, General Motors Corp., Detroit Diesel Allison Division, *4700 W. 10th St., Indianapolis, Indiana* 46206 (DN889783; N00140-78-C-0027)

The objectives of this program are to develop, verify and demonstrate computer software (control logic) capable of closed-loop control of an advanced variable cycle engine (VCE).

This program is planned as a two-phase effort of approximately 30 months duration. Phase I consists of control logic development, input signal characterization, control diagnostics and engine condition monitoring logic development; software coding and checkout on the hybrid computer, and finally on-engine demonstration during the build-up (BU) 1 test of the JTD engine. Phase II will consist of the updating of the control and diagnostic logic, updating and re-coding the software, and demonstration on the BU 2 and the BU 3 test of the JTDE. The control logic will be programmed into the Bendix EH-R1 engine-mounted digital controller for the demonstration. Alternate control logic will be developed for verification via hybrid computer simulation, which will fully demonstrate the VCE features, such as airflow regulation, specific fuel consumption (SFC) optimization, thrust response optimization, etc. The logic will include control system diagnosis as well as some sensor, actuator and engine performance condition monitoring.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

4.0032, BACKSCATTERING FROM INHOMOGENEOUS MEDIA WITH IRREGULAR BOUNDARIES 16636-GS

A.K. Fung, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Electrical Engineering, *Learned Hall, Lawrence, Kansas* 66044 (DA0G3256; DAAG29-80-K-0018)

Theoretical studies will be made to establish radar backscatter models for inhomogeneous media with irregular boundaries with emphasis on vegetation and snow-covered terrain. Relevance - this research is directly applicable to ongoing work at ETL on EM signatures from terrain as well as other Army programs involving discrimination of targets from the background.

Various volume-scattering models and rough surface-scattering models will be examined and theory developed to combine the two effects in a rigorous and practical manner. Concur-

rent 'ground truth' measurements will provide a check and guide for the theoretical modeling.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0033, PACKET SPEECH

B. Gold, Massachusetts Inst. of Technology, Lincoln Lab., *244 Wood St., Lexington, Massachusetts* 02173 (DF306616; F19628-80-C-0002)

The objective of this program is to develop and demonstrate techniques for efficient digital speech communication on networks suitable for both voice and data, leading eventually to better interaction between people and computers. This work is carried out in conjunction with other ARPA contractors in the Network Speech Compression (NSC) Group sponsored by the Information Processing Technology Office of ARPA.

Starting in FY79, the Packet Speech and Wide-band Integrated Voice/Data Technology Programs will be merged under the title 'Packet Speech Systems Technology.' The merger reflects the strong coupling between voice algorithm and terminal designs, and communications networks requirements. During FY79 efforts will be directed toward the refinement of the spectral envelope estimation algorithm developed in FY78, and toward the continued development of variable rate algorithms that satisfy requirements for adaptive voice flow control in advanced integrated packet-switching systems. In addition, attention will be directed at voice terminal designs, with the goal of specifying a complete packet speech terminal for use in the wide-band network and other packet-switching systems. Work on satellite voice conferencing, internetted voice conferencing, and the development of LSI speech processor hardware will continue, leading toward operational capabilities and systems experiments in the wide-band network.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Electronic Systems Div.

4.0034, ROLE OF COUPLING AGENTS ON METAL-POLYMER ADHESION 16355-MS

N.H. Sung, Massachusetts Inst. of Technology, School of Engineering, Dept. of Mechanical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DA0G9155; N/A)

To study the role of silane-type coupling agents on the promotion of adhesion and wet-strength in polymer-metal joints. Relevance - the research is relevant to composite technology, and bonded joint technology for Army helicopters, protective masks, chemical and biological defense items, and encapsulation of electronic devices.

Characterization of the substrate/coupling agent and coupling agent/polymer adhesive interfaces using Fourier transform infrared spectroscopy and ESCA. Mechanical testing of bond strengths using peel tests. Failure analysis of failed joints.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0035, DESIGN/DEVELOP AEROSPACE RESEARCH INSTRUMENTS

S.J. Rochefort, Northeastern University, School of Engineering, Dept. of Electrical Engineering, *360 Huntington Ave., Boston, Massachusetts* 02115 (DF242400; F19628-78-C-0218)

AF function - nuclear weapons delivery, communications, detection, track and intercept stratospheric operations. Deficiency - inability to forecast atmospheric interactions affecting the design and operation of military systems such as reentry vehicles, over-the-horizon radar, polar communications and satellite ephemerides. Insufficient data to accurately predict environmental effects of stratospheric operations. Objective - to increase ability to forecast atmospheric variables requires measurements by sounding rocket and balloon experiments. How research contributes - provides instruments for conducting experiments measuring the composition and densities of ion and neutral species of importance to AF systems operations.

The contractor will design and operate electronic instruments for mass spectrometer and related experiments as required for a series of rocket and balloon-borne ion and neutral atmospheric composition measurement programs. The design of each experiment will be coordinated with parallel laboratory and other related programs while being updated according to the results of the preceding experiments. Research, development and test of components and assemblies are undertaken to create reliable operating instruments for rocket and balloon experiments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0036, STATISTICAL IMAGE PROCESSING FOR REAL-TIME OPERATIONS

C.H. Chen, Southeastern Massachusetts University, School of Engineering, Dept. of Electrical Engineering, *North Dartmouth, Massachusetts* 02747 (DN975533; N00014-79-C-0494)

The objective of this effort is to improve the Navy's surveillance capability to detect, identify and track targets by creating and developing improved statistical and probabilistic methodology applicable to satellite technology.

Statistical and probabilistic research will be conducted in several areas, including (1) comparative evaluation of decision rules, (2) statistical feature-extraction for image recognition and segmentation, (3) statistical contextual analysis of images, and (4) statistical modeling of images.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0037, SPACE ENVIRONMENT ENGINEERING SPECIFICATION

W.R. Neal, Spire Corp., *Patriots Pk., Bedford, Massachusetts* 01730 (DF583940; F19628-80-C-0055)

AF function - satellite communications and survivability. Deficiency - insufficient knowledge of engineering requirements for simulation of space environments. How research contributes - enables AFGL environmental models to be more efficiently applied to the problem of space environment specification. This work will contribute significantly in definining the key environmental parameters for the MIL Standard for spacecraft charging. Objective - development of algorithms for selecting beams for space plasma simulation and subsequent engineering evaluation, leading to engineering specifications for a possible future spacecraft charging test facility.

Stellar chromospheric activities will be correlated with observable parameters which have solar counterparts, thus providing a better understanding of the solar activity cycle.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0038, LASER PROTECTION PROPERTIES OF SOME TRANSITION ELEMENT BORIDES

T.V. Hynes, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0F4800)

The protection of metal surfaces from damage by high-energy lasers will be enhanced by an understanding of the interaction mechanisms. Coatings of borides will be prepared and deposited on metals in film form to increase beam decoupling. The properties of such protective coatings will be measured as a function of the usual laser test parameters.

Titanium diboride has unusual conduction properties. Theory indicates that the infrared reflectivity is dependent on the metallic conductivity leading in this case to a possibly enhanced protection against laser damage. Other borides will be investigated for such behavior. Nickel and cobalt borides will be investigated and attempts will be made to deposit films on suitable substrates. Differences in damage levels will be related to relevant laser test conditions and sample properties.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

4.0039, NAVY ENVIRONMENT - SYNTHETIC APERTURE RADAR SENSING OF THE OCEAN SURFACE
R.A. Shuchman, Environmental Research Inst. of Michigan, *P.O. Box 8618, Ann Arbor, Michigan* 48107 (DN675694; N00014-76-C-1048)

All-weather and day/night remote assessment of coastal wave-spectra and other sea-surface characteristics is desirable for a variety of Navy and Marine Corps operations; it may also provide clues on underwater topography. Only the synthetic aperture radar offers sufficient resolution for this task. The problem of uniform target motion is basically solved. Accelerated waves still pose a problem. Above all, the reflection mechanism of electromagnetic waves from water waves is still unexplained; it seems to involve an interdependence mechanism between large and small water waves.

Contractor will apply the results from his work up-to-date to the scientific planning of a multidiscipline field experiment covering the coasts and seas from North Carolina to across the Gulf Stream in order to get more simultaneous measurements from synthetic aperture radar and in situ from the sea surface in order to quantify the radar signatures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0040, REGIONAL SCALE HAZINESS - ORIGIN, SPATIAL-TEMPORAL DISTRIBUTION PROPERTIES AND EFFECT ON ATMOSPHERIC RADIATION
R.B. Husar, Washington University, School of Engineering & Applied Science, Dept. of Mechanical Engineering, *4559 Scott Ave., St. Louis, Missouri* 63130 (R806606; GC05 -0231)

OBJECTIVE: Provide direct, continuous, real-time measurements of sulfate for ORD-ESRL field studies. Participate in analysis of sulfate data in terms of formation, removal, and transport.

APPROACH: Modify Meloy flame photometric sulfur analyzers for continuous sulfate analysis. Supply to participants in state field studies. Modify instruments for direct instead of square root signal processing. Provide calibration and maintenance of instruments. Participate in analyzing data from continuous sulfate instruments.

PROGRESS: Instruments supplied for PEPE field study, summer 1980. Data analysis in progress.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

4.0041, GENERATOR TEST STAND DRIVE SYSTEM
S.M. Reustle, U.S. Dept. of Defense, Navy, Naval Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN096127)

Develop a drive motor system to be incorporated in future generator test stands capable of testing present and future aircraft electrical generator stands.

Present and future generator test stand drive system requirements will be determined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0042, ENGINEERING AND INSTRUMENTATION SUPPORT FOR ROCKET-LAUNCH OPERATIONS
K.E. Lane, New Mexico State University, Las Cruces Campus, Physical Science Lab., *P.O. Box 3548, Las Cruces, New Mexico* 88070 (DF583440; F19628-79-C-0107)

AF function - command, control and communications. Deficiency -limited engineering and instrumentation support available at WSMR, New Mexico, to support scientific rocket-launch operations. Objective -provide effective engineering and instrumentation support during the launching of scientific rockets at WSMR. How research contributes -instrumentation systems will be developed for each rocket to be launched by AFGL at WSMR. The engineering and instrumentation support will allow AFGL scientists to conduct aerospace investigations on a timely and cost-effective basis. Projects depending on this work include 6690, 2123, 2310, 7670 and 7659.

The technical approach includes integrating range safety, tracking and recovery systems into rocket payloads that will be launched at WSMR in support of various scientific programs. A telemetry facility will be maintained to provide for pre-launch testing of rocket instrumentation systems and to assure payload operational readiness. Operation of various telemetry facilities in support of rocket-launch operations will be accomplished by use of government-owned equipment located at WSMR. Coordination will be provided between AFGL Instrumentation Engineering and WSMR to satisfy documentation on other technical interface requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0043, SOLID ROCKET MOTOR IMPACT RESPONSE STUDIES
D.C. Bickells, U.S. Dept. of Energy, Albuquerque Operations Office, *Albuquerque, New Mexico* 87115 (DF188770)

The objective is to provide experimental data on the impact response of solid propellant rocket motors (SRM). More specifically, this work will provide data on the stress/strain history of an SRM after impact and measurements of the analytically nonconducive fracture/fragmentation problem. The data are to provide experimental data bases for safety engineering studies related to the nuclear safety evaluations of current and future DOD orbital/deep space missions through the STS time frame.

Impact tests at varied impact velocities and orientations will be conducted at Sandia Laboratories, Albuquerque. Impacting mediums will include (1) unconstrained solid propellants, (2) scale model SRMs, and (3) full-scale segments of SRM. Full instrumentation and photographic coverage will be provided.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

4.0044, STUDY OF PROPERTIES OF HETEROJUNCTION STRUCTURES FOR MICROWAVE DEVICES
L.F. Eastman, Cornell University, Ithaca Campus, School of Electrical Engineering, Dept. of Electrical Engineering, *Ithaca, New York* 14850 (DN575176; N00014-75-C-0739)

Future developments and improvements in solid-state microwave devices for Navy systems will result from better understanding of how material properties affect device operation. Thin film electron devices are very sensitive to processes which occur at interfaces between two solid materials. This research will study parameters which affect the performance of microwave devices in gallium arsenide and alloy III-V semiconductors.

There are three facets to this program, with the focus on the growth and preparation of thin film heterostructures of the III-V compound semiconductors and subsequently their application to microwave devices. Molecular beam epitaxy (MBE) and liquid phase epitaxy (LPE) techniques will be developed and improved in order to form heterostructures with low impurity content. Controlled doping of layers of various binary and ternary semiconductors will be used to form high-resistivity layers for buffer layer-heterojunctions for field effect transistors (FETs). Electrical measurements will be made and the results used to influence the MBE growth techniques. Auger electron spectroscopy, photoemission spectroscopy, scanning Auger microscopy and scanning transmission electron microscopy will be used to analyze the compositional properties of the heterojunction interfaces. This information will be correlated with the electrical measurements and MBE growth developments.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0045, ASYMPTOTIC METHODS, ESPECIALLY IN COMBUSTION 15882-M
G.S. Ludford, Cornell University, Ithaca Campus, School of Engineering, Dept. of Theoretical & Applied Mechanics, *242 Carpenter Hall, Ithaca, New York* 14853 (DA0F9247; DAAG29-79-C-0121)

To perform a mathematical analysis of combustion with special stress on quenching and the deflagration to detonation transition. Relevance - analytical techniques to be developed will enable better understanding of combustion phenomena. Some specific applications include fuel-air explosives, deflagra-

tion to detonation transitions in propellants and other ballistic calculations.

Large activation energy asymptotics, peculiar to combustion problems, will be employed.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0046, AN ANALYSIS OF AN INVENTORY SYSTEM FOR INTERCHANGEABLE RECOVERING ITEMS

J.A. Muckstadt, Cornell University, Ithaca Campus, School of Engineering, Dept. of Operations Research, *242 Carpenter Hall, Ithaca, New York* 14853 (DF051740; AFOSR-78-3568)

AF function - to repair and maintain complex equipment in aerospace vehicles and ground installations, and to develop better methods in inventory control to expedite the performance of the required maintenance. Deficiency - in many situations, a faulty component can be replaced by any of several types of parts, with some parts being more sophisticated or versatile than others because of possible demands in other more complicated systems than the one under repair. How many of the various types to stock, and which of several kinds to use when replacement is possible entails decisions for which there is no satisfactory basis at this time. Objective - to develop analytic tools that will aid in the study of this problem area. How work contributes -success in this research could lead to significantly smaller inventory costs or fewer back-orders, with a smaller proportion of inoperable machines.

The two-echelon supply system will be somewhat simplified to get an efficient model, and a number of intuitively near-optimal substitution rules will be evaluated. Analytic procedures will be used where possible, exploiting good approximations to the extent possible. Computation simulations will be used where necessary.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0047, ANTENNA FEED TECHNIQUES

P.R. Franchi, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF903710)

To provide a simple design that will have very low sidelobe yet will be capable of electronic scan in elevation with a wide bandwidth. The requirements of possible future tactical air surveillance radars are the goals set for this effort.

The design, fabrication and testing of a (pillbox type) reflector-feed system. This type antenna will provide information on the azimuth pattern of a large parabolic cylinder with a phased-array feed system. The feed spillover, illumination taper, and impedance and reflector tolerance are the critical concerns.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0048, DEVELOPMENT OF X-RAY LASER MEDIA - MEASUREMENT OF GAIN AND DEVELOPMENT OF CAVITY RESONATORS FOR WAVELENGTHS NEAR 130 ANGSTROMS

M.J. Lubin, University of Rochester, School of Engineering & Applied Science, Dept. of Aerospace & Mechanical Science, *260 Crittenden Blvd., River Campus Station, Rochester, New York* 14627 (DF026400; AFOSR-77-3189)

AF function - operation of high-altitude vehicles in a post-nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand fundamental understanding of energy transformation processes occurring in plasmas such as X-ray lasing media. Deficiency - the aforementioned information required to design advanced equipment is not available today. Its acquisition may be realized by a well-planned theoretical and experimental research. Objective - this project will investigate both theoretically and experimentally the fundamental characteristics of energy transformation processes. It will specifically study various X-ray lasing media, concentrating on 3P-3S transitions in carbon-like ionization states of elements in the vicinity of argon, in the periodic table. Contribution - this work is part of a comprehensive program of plasma research for the development of an X-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam), the development of space and ionospheric communications and the development of countermeasures.

This project will perform theoretical and experimental work to understand the energy transformation processes occurring in X-ray lasing media. They will attempt to demonstrate soft X-ray lasing action in the vicinity of a wavelength of 100 Angstroms by focusing very intense laser pulses onto moderate atomic weight solid targets and provide for enhanced cooling of the resulting hot-expanding corona. A variety of enhanced cooling schemes will be studied. Line focus plasmas will be emphasized and a direct measure of the gain coefficient will be obtained from the angular distribution of the amplified spontaneous emission. Methods of fabricating normal incidence soft X-ray reflectors will be investigated to develop a cavity resonator. Emphasis will be placed on reflectance measurements of Langmuir-Blodgett multilayers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0049, GAS CORRELATION FOR HYDROCARBONS

D.E. Burch, U.S. Environmental Protection Agency, *Research Triangle Park, North Carolina* 27709 (DF336420)

To determine the feasibility of using a gas correlation method for the remote (non-contact) sensing of hydrocarbon pollution generated by Air Force operations. Presently available point-monitoring sensors have proven unreliable or inappropriate for determining the contribution of airfield operations to local environmental quality. A remote system would provide an integrated pollutant load.

An existing gas correlation instrument will be modified to sense hydrocarbons. High resolution spectra will be furnished by the EPA project officer for use by the contractor to determine the most promising approach.

This project is joint-funded with EPA.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

4.0050, LOW-PROFILE ELECTROMECHANICAL CONTROL ACTUATOR FOR MISSILES

R. Feucht, Lear Siegler Inc., *Maple Heights, Ohio* 44137 (DF143310; F33615-79-C-3603)

This program addresses the capability to control high-performance missiles. Current hydraulic and pneumatic missile actuators have deficiencies such as shelf-life problems, are difficult or impossible to check pre-launch, have low reliability and are usually expensive to maintain. The objective is to develop and demonstrate low-profile, high-temperature electromechanical (EM) flight control actuators that will provide up to 3000 in/lbs of torque, frequency responses up to 30 Hz and having a temperature range of -65 to 600 degrees F. EM actuators provide high-performance missiles with high-temperature operational capability, improved maneuverability, lower weight-cost and volume, checkability, and simplified actuation equipment via eliminating complex hydraulic or pneumatic secondary power sources.

A design trade-off study will be conducted to define the best technical approach to achieve an EM actuator having an optimum overall high-performance capability, low-weight volume and cost and a low-profile configuration. Output of the study is to provide a viable gear train, electric motor and electronic control arrangements that will allow optional schemes for mechanizing the desired actuator. It is anticipated that a samarium cobalt permanent-magnet-type motor will be developed to drive the actuators. All components will be designed to perform at elevated temperatures. Initially, components will be fabricated and tested as developmental units and subsequently assembled as breadboard actuators and tested to validate performance. Subsequent to breadboard performance validation, a final design will be established, fabricated and tested to demonstrate that the

specified statement-of-work flight control requirements have been achieved.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0051, STUDIES OF RAPID ION TRANSPORT IN SOLIDS
J.C. Wang, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF459110)

To increase fundamental understanding of solid electrolyte systems through use of theoretical calculation and recent experimental techniques applicable to studies in solid-state physical chemistry.

Study various possible local correlated motions of ions to find the correct mechanisms for conduction. Compare the calculated activation energies, jumping frequencies, and conductivities with experimental results. Perform experimental studies with possible high voltage couples using Pb and Bi.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0052, INVESTIGATION OF METHODS OF PLASMA EXCITATION
M. Lake, Universal Energy Systems Inc., *Dayton, Ohio* (DF461390; F33615-77-C-3113)

AF function - communication illumination weaponry. Deficiency -lack of data on efficient methods of plasma excitation and of microscopic excitation processes. Research - experimental analysis of excitation methods and cross-sections. How research contributes -provides total ionization cross-sections and excited-state cross-sections in both atomic and molecular gases. Microwave excitation provides efficient distributed discharge excitation.

The research will be conducted using three existing experimental configurations located in bldg. 450, WPAFB. They are a cross-beam excitation analyzer (2XB), a fast Fourier transform (FFT) facility and a microwave excitation facility.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0053, MULTIPLE IGNITION, COMBUSTION, AND QUENCHING OF HYDROCARBON FUEL SPRAYS
W.A. Sirignano, Carnegie Mellon University, Carnegie Inst. of Technology, Dept. of Mechanical Engineering, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (DF058770; AFOSR-80-0203)

AF function - weapon delivery and defense, transport, advanced air-breathing engines, aircraft vulnerability and survivability. Deficiency - insufficient understanding of the basic physical, chemical and fluid dynamic processes of multiple ignition, propagation, and quenching of flames in spray-air mixtures. Lack of guidelines for predicting potential flame/detonation quenching techniques. Objective - to clarify the relative importance, and to formulate realistic analytical representation, of the mechanisms of multiple ignition by hot metal particles, flame propagation and quenching in fuel-air sprays occurring in air-breathing propulsion system dry bays and fuel tanks. How work contributes - will provide additional understanding and needed realistic analytical modeling of multiple ignition, and flame propagation and attenuation through air-fuel sprays not now available. Will contribute to establishing realistic guidelines and techniques for minimizing ignition probability and maximizing flame quenching and attenuation.

Theoretical and experimental studies will be made of basic fluid dynamic, physical and chemical processes of ignition of hydrocarbon fuel sprays by clouds of hot metal particles acting as multiple ignition sources and associated combustion, detonation, and quenching in aircraft fuel tanks and dry bays. The relative importance of gas phase kinetics, heat transfer, mass diffusion, and surface chemical kinetics will be assessed. The practical phenomena will be experimentally simulated. The occurrence of absence-of-ignition of combustible gas by metal particles will be measured as a function of metal particle size, temperature, gas-phase composition, and spray characteristics. Deficiencies in existing mathematical models will be demonstrated and improved models formulated based on experimental data and field observations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0054, ADVANCED SONDE TECHNOLOGY
E.T. Schmidt, U.S. Dept. of Defense, Navy, Naval Air Development Center, Sensors & Avionics Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881360)

Provide advanced technologies to support the development of the balloon-launched minirefraction sonde and the aircraft-launched dropsonde. Both sondes provide real-time vertical refractive conditions affecting system performance (surveillance, communications, electronic warfare). This effort is supported by work unit XH501B and XH501B1.

Identify current sondes' weaknesses and/or areas for potential improvements. Combine the functions of the air-deployable expendable bathythermograph AXBT with the refraction dropsonde into a single A-size housing, combining the functions of wind-sensing and the minirefraction sonde. Provide the airborne ASW platforms with detailed applications analysis for implementing the refraction dropsonde and its derivatives to tactical mission enhancement. Plan and execute an experiment in areas of predictably high occurrence of refractive effects to determine both the quantitative effects of the environment on ASW aircraft sensors and the atmospheric horizontal homogeneity.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Systems Command, Tech Admin.

4.0055, SCIENCE OF FRACTURE
M.L. Williams, University of Pittsburgh, School of Engineering, Dept. of Engineering, *402 Engineering Hall, Pittsburgh, Pennsylvania* 15213 (DF053120; F49620-78-C-0101)

AF function - improved durability and reliability of aerospace flight vehicles are of major importance to insure flight safety and reduce life-cycle costs. Deficiency - the basic understanding of the fracture of structural material that exists is inadequate to meet desired Air Force capabilities. Objective - to understand the basic mechanisms of fracture and the associated structure-property relationships of structural materials. How work contributes - research results will directly contribute to the improved performance of flight structural systems.

This research project is organized into four basic research areas and two areas of technology integration and assessment. Research will be investigating 1) analytical efforts and basic mechanisms, 2) structure-property relationships, 3) numerical analysis methods, and 4) instrumentation science. Areas one and two will receive major emphasis during the first two years of this program. These topics will focus on the science of fracture for metals, polymers and ceramics. The remaining research areas will be funded at a much lower level and will increase as a consequence of the natural progress of the research. The areas of technology integration and assessment will also be funded at a low level. The purpose of these areas is to engage in an active process of technology integration with development programs and applications. This activity will insure the rapid use of research results and the identification of critical issues dealing with fracture processes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0056, THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF RF PLASMA HEATING
M.O. Hagler, Texas Tech University, School of Engineering, Dept. of Electrical Engineering, *P.O. Box 4340, Lubbock, Texas* 79409 (ENG77-12728)

An experimental and theoretical investigation will be undertaken of (1) the fundamentals of low-frequency (a few times the ion cyclotron frequency or less) wave propagation and heating in toroidal plasmas, and (2) various couplers that might be used to launch these waves. The work will extend previous efforts in linear geometry. A small Tokamak facility, a relatively high-power broadband linear radio frequency amplifier, and relevant remote and shielded probe diagnostic methods will be used in the experiments. Measurements will be first performed using

deuterium and then with differing relative concentrations of hydrogen. Damping mechanisms at ion-ion hybrid resonance and ion cyclotron frequencies will be explored for plasmas containing two ion species.

This is a continuation of research previously supported under NSF grant ENG-7303941AO1.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering

4.0057, 10-MICRON FLIR RANGE FINDER/DESIGNATOR INTEGRATION

J. Fox, U.S. Dept. of Defense, Army, Electronics Research & Development Command, Night Vision & Electro Optics Lab., *Fort Belvoir, Virginia* 22060 (DA0F2051)

The objective of this program is to identify and study various concepts for integrating a 10-micron laser range finding/designating function with the common module FLIR. This will result in a capability for acquisition, recognition, ranging and designating targets for all-weather and smoke conditions.

Various concepts will be investigated and a trade-off analysis will be performed to define the optimum sensor package design with minimal impact upon FLIR performance and versatility. Promising concepts will be tested experimentally and feasibility established.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Night Vision & Electro Optics Lab.

4.0058, TRI-SERVICE PROGRAM FOR EXTENDING MISSILE AERODYNAMIC DATA BASE

Nielsen, U.S. Dept. of Defense, Navy, Office of Naval Research, *800 N. Quincy St., Arlington, Virginia* 22217 (DF650010)

A great deal of progress has been made in recent years in reliable aerodynamic performance-predictive methods for missiles. These methods are extremely valuable in missile design studies. One of the most successful predictive computer codes, Program Missile, is currently in wide use in both industry and government. This predictive code, which depends on a combination of data base and rational flowfield modeling, still has limitations. These limitations are primarily due to holes in the experimental data base for certain ranges of Mach numbers, fin aspect ratio, and angle-of-attack. It is the objective of this research effort to eliminate these holes through a systematic experimental program.

The aerodynamic data base for Canard Cruciform missiles will be systematically expanded in a wind tunnel test program. The data will fill voids in the current data base in Mach numbers, aspect ratio, and angle-of-attack. The predictive capability of Program Missile will be expanded using the new data base and by extending the associated rational flow modeling.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

4.0059, VIBROTHERMOGRAPHY - INVESTIGATION OF A NEW NONDESTRUCTIVE EVALUATION TECHNIQUE 16202-MS

K.L. Reifsnider, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Engineering Science & Mechanics, *Blacksburg, Virginia* 24061 (DA0G8959; DAAG29-79-G-0037)

To determine the mechanisms responsible for evolution of heat in mechanically loaded materials, especially in the neighborhood of materials defects, and to study limitations in techniques to detect the evolution of heat. Relevance - this research is relevant to the nondestructive evaluation of composite materials used in structures, penetrators, armor, helicopter and missile components, and to understanding of the mechanisms of fatigue failure in composite materials.

Isolation and characterization of the various processes known to generate heat in materials (plastic deformation, rubbing of mating surfaces, elastic hysteresis, release of strain energy, dispersion and attenuation of stress waves). Measurement of evolution of heat from a series of well-characterized flaws which are cyclically loaded. Modelling of the heat transfer from defects in solids. Comparison of theory with results on state-of-the-art manufactured materials.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0060, AERODYNAMIC FORCES EXERTED ON AN ARTICULATED HUMAN BODY SUBJECTED TO WINDBLAST

D.J. Schneck, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Engineering Science & Mechanics, *Blacksburg, Virginia* 24061 (DF053540; AFOSR-78-3706)

AF function - the Air Force operational environment involves exposure to a wide variety of mechanical forces, including flail and impact. These forces are of special significance in relation to the incidence of ejection from high-performance aircraft where the probability of disabling injury is unacceptably high. Deficiency - this research will provide input data needed for an elaborate biomechanical computer model of the human body which has been developed to determine the stresses, strains and injury mechanisms due to windblast during ejection. Objective - development of the theory of windblast effects on the human body as initiated under USAF/ASEE summer faculty research program and a recent mini-grant effort; examine the contribution of flow separation to limb flail during ejection; provide data for wind tunnel tests and for the articulated total body model studies at AMRL. How research contributes - this research will contribute directly to subarea 1.8, 'Aircrew Safety and Effectiveness in Mechanical Force Environments.'

The researcher will elucidate the contribution of flow separation to the factors which initiate limb-dislodgment forces during ejection. These data will provide input to the AMRL articulated total body model, which will analytically describe the dynamics of ejection. Specific attention shall be focused on elucidating the time-dependent characteristics of the limb-dislodging forces, and on extending the analysis to include the head/neck configuration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0061, PERIODIC SHEAR FLOW

J.J. Riley, Flow Industries Inc., Flow Research Division, *21414 68th Ave. S., Kent, Washington* 98031 (DN875378; N00014-78-C-0346)

Mixing phenomena play a central role in many fluid dynamic applications ranging from thrust augmentors and ejectors to combustors and chemical lasers. The proposed research will use direct numerical simulation techniques to study turbulent, pulsatile shear flows.

A study will be made of the turbulence in a two-dimensional mixing layer upon which periodic unsteadiness is imposed. The full nonlinear equations of motion will be solved by spectral methods; no turbulent closure assumption will be necessary. The mixing layer will be assumed to be homogeneous in the transverse and downstream directions; periodic boundary conditions will be imposed in these directions. Some preliminary numerical studies will be made of nonperiodic mixing layers and of the instability of laminar, periodic mixing layers.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0062, BOUNDARY LAYER SEPARATION ON LOW-SPEED COMPRESSOR BLADING

J. Breugelmans, Von Karman Inst. for Fluid Dynamics, *Rhode St. Genese, Belgium* (DF702720; AFOSR-80-0119)

AF function - research in fluid mechanics of rotating turbomachinery. Deficiency - compressor stall and surge are two factors which have a great effect on the off design performance of jet engines. A better understanding of these phenomena is necessary for improved prediction and design methods. Research - the researcher proposes to perform direct measurements of the behavior of the boundary layer along the blade of an operating compressor. How the research contributes -compressor stall and surge are directly related to events in the boundary layer. Early

separation will decrease the operating range and efficiency of the compressor. Direct measurement of boundary layer behavior will improve our understanding of the underlying causes of compressor stall and surge.

The VKI R4 1000 hp rotor facility with single-stage aerial flow compressor is proposed. Using fast-response instrumentation, the blade-to-blade temperature profile will be detected with a hot wire, operating at different overheat ratios. Pressure variations will be detected by probe-mounted Kulite transducers. Use will be made of the VKI data acquisition system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, European Office of Aerospace Research & Development

4.0063, ENERGY CONVERSION - LIQUID/METAL MAGNETOHYDRODYNAMICS (MHD) POWER GENERATION FOR NAVAL APPLICATIONS

H. Branover, Ben Gurion University of the Negev, *P.O. Box 2053, Beersheba, Israel* (DN475248; N00014-77-G-0034)

Investigate the internal structure of single-phase and two-phase turbulent and laminarized MHD flows in channels of high-aspect-ratio rectangular cross-sections. Determine optimal hydrodynamic conditions to control phase separation, end-effects and pressure losses.

Conduct experiments with the magnetic field in two positions, perpendicular and parallel to the longer side of the cross-section. Measure pressure drop, mean velocity profile and turbulence characteristics. Particular attention will be given to the end-effects and to phase separation in two-phase flow.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, RESEARCH IN RADAR APPLICATIONS

H. Masursky, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeological Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (0-9580-02347)

STATES TO WHICH PROJECT PERTAINS: Oregon, Utah, Arizona, Nevada.

Side-looking radar images have been obtained by the Environmental Research Institute of Michigan of four geologically interesting test areas, using a radar system similar to that currently used by the Pioneer Venus Mission, and are planned for the VOIR mission. Areas chosen for the tests include the Mt. Hood, Oregon, and Beowawe, Nevada, geothermal areas, the Moab, Utah, nuclear waste disposal candidate site, the San Francisco volcanic field near Flagstaff, Arizona, and a geologically diverse area near Elko, Nevada, cut by recent faulting. Radar images obtained of the Mt. Hood, Beowawe and Moab areas will be combined with information obtained from other data sets in order to evaluate the geologic and economic potential of the areas studied. Simultaneous imaging at X-band and L-band frequencies at Mt. Hood, Flagstaff and Elko will enable us to compare images obtained with the widely used X-band instrument to less understood L-band images, similar to those that will be obtained on future planetary missions.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0002, SATELLITE EQUATORIAL SCINTILLATION STUDY

M.R. Paulson, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Environmental Sciences Dept., *San Diego, California* 92152 (DN988526)

Acquire a data base which can be used to develop a statistical model of equatorial scintillation of satellite signals. Such a model could be used to predict the probability of the occurrence of significant equatorial scintillation at any given time and the extent to which satellite communications are adversely affected.

Record the signal amplitudes at Guam from the two Gapfiller/MARISAT satellites at 257 & 1541 MHz for six months or more. This will provide data on scintillation activity and intensity at two frequencies and two elevation angles, 11 degrees and 51 degrees. Calculate amplitude distributions and cumulative amplitude distributions, mean and STD deviations, and fade duration distributions for several fade depths. These calculations would be made as a function of time for each of the satellites and each frequency.

SUPPORTED BY U.S. Dept. of Defense, Office of Naval Research, Earth Sciences Div.

5.0003, SONORAN EARTHQUAKE OF 1887 - EARTHQUAKE TECTONICS OF SOUTHERN ARIZONA, SONORA AND CHIHUAHUA

D.G. Herd, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Western Environmental Geology, *345 Middlefield Rd., Menlo Park, California* 94025 (9540-02685)

The geologic setting of the Sonoran earthquake of 1887 will be explored by aerial photographic interpretation and reconnaissance field mapping (1:50,000). Accounts of the earthquake will be reviewed and compared with the geologic record to reconstruct a detailed picture of the shock and its effects.

A series of companion maps (scale 1:250,000) identifying recently active faults both near the surface rupture of 1887 and in the surrounding Sonoran Desert of southern Arizona and northern Sonora and Chihuahua will be prepared. The faults will be mapped primarily by aerial photographic interpretation and limited field work. The faults will be classified, where sufficient geologic information exists, by age of last displacement.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0004, METEOROLOGICAL OBSERVATIONS

L.O. Grant, Colorado State University, Agricultural Experiment Station, Dept. of Atmospheric Science, *Fort Collins, Colorado* 80523 (0009900; COL00104)

OBJECTIVE: Obtain meteorological data at the Colorado Experiment Station. Establish the climatology and climatological changes at the observing point. Obtain meteorological data to assist in aircraft flight forecasting by the National Flight Control System.

APPROACH: Complete observations are taken at 7:00 a.m. and 7:00 p.m. MST. Airway observations are made 12 times each day on odd hours. The data are relayed by TWX to the Weather Bureau in Denver for dissemination via teletype.

PROGRESS: Meteorological observations are made at the University Weather Station to support agricultural and engineering research and to assist in operational aspects of flight forecasting by the U.S. Weather Bureau. Weather observations have been made at this station since 1873, and continuously since 1887. Parameters observed include: sky conditions, present weather, pressure, earth temperature, soil temperatures, humidity, wind, radiation, dew and frost deposition and evaporation during ice-free seasons. Complete observations are made twice daily at 7 a.m. and 7 p.m. MST. Airways observations are made 12 times daily on all odd number hours. All of the station records from 1890 to 1972 have now been transferred to computer tapes. The compilation of a comprehensive climatology based on the availability of the computer tapes has been deposited with the Colorado State Climatology Office. A limited observation setup at the foothills location in cooperation with the Colorado State Forest Service and the Department of Atmospheric Science allows contrast between the foothills and main campus sites as well as providing forest fire weather data and data related to foothills grazing lands. The findings include daily operational and benchmark meteorological observations.

SUPPORTED BY Colorado State Government

5.0005, CLOUD EFFECT ON TROPICAL SST

A. Leetmaa, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302

PROJECT OBJECTIVE: To investigate the effect of persistent low-level cloud covers on the origins and effects of

large sea surface temperature (SST) anomalies in the eastern tropical Pacific Ocean.

CURRENT YEAR PLAN: To finish model development.

PROGRESS REPORT: Two papers have been completed by Dr. Howard Hansen and Ms. Grubor will finish her Master's thesis by December, 1980.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0006, LIGHT-STABLE ISOTOPES - DENVER

I. Friedman, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (0-9740-00382)

Establish remote-operating helium-sniffer for material hazards applications and geothermal uses. Gas analysis of volcanic emanations by airborne techniques. Obsidian hydration dating applied to natural hazards applications and geothermal investigations. Investigation of light-stable isotopes in tree rings for paleoclimatological purposes.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0007, GEOLOGIC APPLICATIONS OF THERMAL-INERTIA MAPPING FROM SATELLITE-HCMM

T.W. Offield, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9790-02189)

To evaluate the effects of scale and resolution changes from both HCMM satellite and aircraft data, to assess the need for topographic correlation at different scales and resolutions, and to develop an automatic topographic correction technique. Also to compare thermal inertia data from aircraft and HCMM satellite with maps of geology, soil type, soil moisture, land use, energy resources, and vegetation to correlate thermal inertia with the target geologic materials.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0008, GEOPHYSICAL INSTRUMENT DESIGN

C.J. Roubique, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9780-01757)

Design and engineering assistance will be provided for development, modification and operation of geophysical equipment used in minerals-related investigations.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0009, COAL GEOLOGY OF THE WASATCH PLATEAU COAL FIELD, UTAH

J.D. Sanchez, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Coal Resources, *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9420-01825)

STATE TO WHICH PROJECT PERTAINS: Utah.

Continued field mapping and compilation of all available data to be used in regional stratigraphy and calculation of coal resources in the Wasatch Plateau coal field coal folio series, Salina, Manti, Nephi 1 degree coal folios.

Continued paleoenvironmental reconstruction of coal-bearing Upper Cretaceous Blackhawk Formation (delta plain) and Star Point Sandstone (delta front).

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0010, FIELD- AND SCALE-MODEL STUDIES OF DENSITY CURRENTS AND CONVECTION SYSTEMS IN LAYERED INTRUSIONS

T.N. Irvine, Carnegie Institution of Washington, Geophysical Laboratory, *1530 P St. N.W., Washington, District of Columbia* 20005 (EAR79-11188)

Layered magmatic (molten rock) intrusions hold special interest in igneous petrology as places where processes of magmatic differentiation are recorded in sufficiently systematic ways that they can be deciphered and interpreted quantitatively. Some of these intrusions also have major economic importance as sites of various ore deposits (Cr, Ni, V, Pt, Ti, Fe). This award supports field studies of three major layered intrusions (in Greenland, Alaska, and British Columbia) and laboratory attempts to simulate and study density currents and convection systems in scale-model experiments. The laboratory experiments are pioneering attempts to apply the techniques of experimental fluid dynamics to magmatic intrusions.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0011, SPATIAL VARIABILITY IN THE OCEAN

R.P. Mied, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN780023)

The program objective is to build models for fluctuations in the ocean environment and to investigate methods for their remote sensing. These environmental models are required for input into acoustic propagation models for underwater surveillance system performance estimates.

Conduct at-sea and numerical experiments and analyze environmental data to develop a physical understanding of the dynamics of fronts and eddies.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0012, NAVY ENVIRONMENT - THE INFLUENCE OF CONVECTING FLOWS IN THE OCEAN AND ATMOSPHERE

R.E. Krishnamurti, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Oceanography, *205 Wildwood Dr., Tallahassee, Florida* 32306 (DN323080; N00014-75-C-0877)

Convective circulation observed in all fluids undergo transitions through several well-defined regimes, leading eventually to turbulence. Flows of this nature occur in the ocean and atmosphere, influencing energy balance in wind-wave interactions, turbulence generation, in subsurface thermocline inversions, and cloud pattern formation as observed by satellite. Each of these fluid dynamic phenomena must be understood for predicting the physical characteristics of ambient environments within which the Navy must operate.

Professor Krishnamurti will conduct an investigation of boundary effects on transitional convective flows and the interaction of them with superposed mean flows. Included will be studies of wind-wave interactions and surface-temperature gradients which lead to convective instabilities in ocean circulation models. Stability and transition to turbulence of some flows will be examined, and the convective effects upon biological maintenance of some species will be completed. The latter study may have implication for some ASW signatures which still remain enigmatic.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0013, A NUMERICAL CLIMATE MODEL STUDY INCLUDING THE PHYSICS OF CONTINENTAL ICE SHEETS AND THE DEEP OCEAN

G.E. Birchfield, Northwestern University, Evanston Campus, Graduate School, Dept. of Geological Sciences, *633 Clark St., Evanston, Illinois* 60201 (ATM78-13961)

Geological time series from deep sea cores suggest that significant climate changes over the last 500,000 years have been produced by insolation variations due to variations of the earth's orbit. Mechanistic and other models of the climate are beginning to elucidate the manner in which these climate changes may have occurred. These climate modelling studies for the most part incorporate only the radiation properties of the cryosphere, and only the upper mixed-layer of the ocean. The proposed research uses the present state of knowledge of the physics of ice sheets to incorporate a physical model of continental ice sheets

together with a greatly simplified model of the deep ocean into a numerical climate model. The purposes of the proposed research are (1) to define and model the essential roles played by ice sheets interacting with the atmosphere-ocean in determining climate, (2) to determine the role, if any, of the ice sheets and ocean on the effects of the time variation of latitudinal distribution of solar energy resulting from the astronomical perturbations of the earth's orbit, and (3) to determine the sequence of events in the earth's system in the transition from interglacial to glacial intervals and vice versa.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0014, CLIMATE - REGIONAL SCALE HAZE TRANSPORT AND EFFECTS

B.B. Hicks, U.S. Dept. of Energy, Argonne National Lab., *9700 S. Cass Ave., Argonne, Illinois* 60439 (005178 TICNO; 66260/003196)

Episodes of increased haze occur periodically over large portions of the United States, especially during summer. With the expected greater pollutant emissions due to increased combustion of fossil fuels, these episodes will probably intensify and occur more frequently. More haze may cause a substantial change in the average solar radiation balance, and the resultant net gains or losses of heat may eventually affect climate and energy demand in the region. This program examines the present spatial and temporal variations of haze in the eastern half of the United States, primarily via measurements of atmospheric turbidity, and evaluates changes in estimated heating rates that occur, with a view toward developing and testing models capable of assessing the regional effects of changes in these phenomena. Since atmospheric turbidity can now be monitored quite easily in the United States, the methods developed here can be applied to use observed or expected haze-induced changes in solar radiation to assess effects on climate.

SUPPORTED BY U.S. Dept. of Energy, Office of
Environment

5.0015, DOPPLER RADAR STUDIES OF CONVECTIVE STORMS

R.C. Srivastava, University of Chicago, School of Physical Sciences, Dept. of Geophysical Sciences, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (ATM80-16150)

A comprehensive observational study of convective storms was conducted in the Chicago area in May and June of 1978. A network of three Doppler radars, the portable automated mesonetwork of the National Center for Atmospheric Research, a dense rain gauge network, and frequent serial radiosondes were some of the observing tools deployed.

This research utilizes the data from the three Doppler radars to continue computation of the three-dimensional wind and reflectivity fields in storms. Data for days with relatively isolated convective cells, mesoscale convective clusters, and squall lines are being analyzed. Some of the problems inherent in deriving wind fields from Doppler radar data are being examined theoretically and by numerical simulations using model storms. Together with the other measurements, the computed flow fields are used to study certain aspects of the dynamics of convective clouds and squall lines, such as: (a) life cycle of relatively isoloated convective cells, (b) interactions between cells in mesoscale lines and clusters, (c) role of momentum transfers by vertical air currents in determining the propagation of convective cells and squall lines, (d) role of the gust front in initiating new convection and maintaining old convection, and (e) some components of the water budget of thunderstorms.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0016, ASSESSMENT OF EFFECTS AND PREDICTABILITY OF CLIMATE FLUCTUATIONS AS RELATED TO AGRICULTURAL PRODUCTION

F.A. Huff, University of Illinois, Urbana Champaign Campus, Graduate School, *Urbana, Illinois* 61801 (ATM76-11379 A03)

This project involves a 3-year, 2-phase program whose major objective is to develop methods which will provide useful estimates of future variations in crop production due to climate fluctuations. Research is to be centered on the 5-state Corn Belt (Illinois, Iowa, Indiana, Ohio, and Missouri) and the three major crops, corn, soybeans, and wheat. The first phase is concerned with relating the time-space variations in production to natural fluctuations in agriculturally relevant climatic factors. This will lead to development of crop-weather relations from which the probability of various levels of crop yield can be determined, in time and space, for one to five consecutive growing seasons. The second phase involves evaluation and further development of potential techniques for statistical prediction of climate trends for one or more years in advance, followed by testing of the most promising techniques in various regions of the United States. Both phases will concentrate on development of techniques which are transferable to other major crop regions in the United States and elsewhere.

This award represents supplemental funding to ATM76-11379.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0017, LOW-ENERGY ELECTRONS OVER THE POLAR REGION BY USING THE USAF OPERATIONAL DMSP SATELLITES

C. Meng, Johns Hopkins University, Graduate School, *Laurel, Maryland* (DF053850; AFOSR-79-0010)

AF function - the accurate knowledge of the polar ionosphere in real-time is vital to transpolar radio wave propagation. Deficiency - an effective method is required for the remote sensing of conditions in the polar ionosphere. Objective - by using data from the USAF DMSP satellites, the electron precipitation characteristics for different auroral activities and other types of low-energy electron precipitation are to be identified. Contribution - after completion of this work, it should be possible to infer global distributions of detailed auroral electron precipitation based on DMSP auroral photographs.

Simultaneous conjugate measurements above the auroral ionosphere and inside the equatorial plasma sheet will be obtained to monitor and model the actual input and output of discrete auroras. The studies of precipitation characteristics of different auroral forms will emphasize the most active forms occurring during auroral substorms and geomagnetic storms. The relationship of the dayside auroral oval to the polar cusp region of the magnetosphere will be determined. Coordinated measurements to study magnetosphere-ionosphere interactions will be made by satellites of optical and particle data and on the ground by magnetometer and radar data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of
Scientific Research

5.0018, DEVELOPMENT AND EVALUATION OF COMPREHENSIVE DYNAMIC ATMOSPHERIC MODEL

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AF function - orbital navigation, orbital surveillance. Deficiency - ephemerides of operational satellites cannot be computed accurately due to lack of knowledge of spatial and time variations of density at critical altitudes. Objective - development of a multi-constituent three-dimensional dynamical model of the thermosphere. How research contributes - new models can be recommended for use by COESA in the development of revised US standard atmosphere supplements and by the NORAD Cheyenne Mountain Space Computation Center for ephemeris computations.

A data base of all available density, composition, temperature, and other structure measurements, and appropriate solar-

geophysical parameters, must be constructed. Current observational and theoretical data existing in the literature will be studied to determine appropriate functional dependencies and degree of complexity to represent variations in each of the constituents. Defining constants associated with these functional forms will be determined in least-squares sense by fitting the satellite-, rocket- and/or ground-based measurements. Method of interpolating between least-squares representations at discrete height intervals must be developed. Tests will be conducted to evaluate model performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0019, PRECIPITATING PARTICLE ANALYSIS

D.A. Hardy, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF585500)

AF function - communications, navigation and command. Deficiency -modifications in the ionosphere caused by precipitating electrons and ions interfere with the operation of Air Force communications and radar systems. Objective - to analyze data from particle spectrometers flown on Air Force satellites to determine the characteristics of precipitating particles and their impact on modification of the ionosphere. How research contributes - an understanding of the characteristics of particle precipitation and its impact on ionospheric modification will lead to increased knowledge of the condition under which Air Force radar and radio systems must operate.

Data have been received from a number of particle spectrometers flown on Air Force satellites. The satellites include F-2, F-3, and F-4 (DMSP) 78-1, and S3-2. The data will be analyzed to study both the details of single passes over the auroral zone and to study the global patterns of particle precipitation. Work will be done on the spectral characteristics of the electrons and ions and their relationship to visual forms, the longitudinal and latitudinal variations in the energy flux, integral flux, and average energy of particles as a function of geomagnetic activity and solar wind parameters, and the total particle and energy input into the oval.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, ANALYSIS AND INTERPRETATION OF GEOPHYSICAL SUPPORT DATA

D.A. Hardy, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584690)

AF function - communication, navigation and command. Deficiency -AF space systems are degraded through interaction with the space environment. There is an inadequate knowledge of magnetospheric processes at geosynchronous orbit and in the polar cap to meet AF requirements. Objective - to analyze the overall behavior of the magnetosphere and to interrelate the conditions for charging as seen at geosynchronous with conditions observed on the ground, in the polar cap and in the solar wind. This will provide a firmer basis for knowing when charging will occur. How research contributes - provides information necessary for building communication satellites that are capable of withstanding damage in severe plasma regimes and aids in specifying these plasma regimes.

Data from Magnetogram and other satellites (DMSP, 78-1, GOES) will be studied for times when the SCATHA satellite is returning data. The data will be analyzed to provide a global picture of the magnetospheric processes taking place in the various regimes and the impact of various plasma regimes on Air Force systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, CELESTIAL AND EARTH-LIMB BACKGROUND MEASUREMENTS

B.D. Schurin, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583060)

AF function - surveillance, reconnaissance, detection. Deficiency - uncertainties in infrared background characteristics now severely limit design of LWIR surveillance and detection systems. Objective - to define the natural infrared background against which surveillance systems must operate. Specifically, to characterize the infrared radiative characteristics of the earth-limb, zodiacal and celestial backgrounds at sensitivity levels and in spectral regions projected for future AF systems. How research contributes - space-based LWIR systems must view their targets against the natural infrared background; characterization of these backgrounds provides a baseline for LWIR mission capabilities and constrains the range of possible system design parameters.

A series of 10 rocket probe flights will be carried out to obtain survey data in the 2-100 micrometers region with advanced state-of-the-art cryogenically cooled sensors. From these data radiance models will be developed for the separate zodiacal, earth-limb and celestial backgrounds. Two infrared sensors are being constructed as an in-house effort for the zodiacal measurements. One zodiacal experiment will obtain measurements to within 10 degrees of the sun; the second will make measurements at greater elongations and at the ecliptic pole. A series of three flights will be carried out to obtain celestial data in the 8-100 micrometers spectral region. One sensor is currently being refurbished and incorporates a three-color focal plane array covering 8 to 32 micrometers. The other sensor is being designed and developed jointly by AFGL and NRL. This instrument will employ a five-color array covering 8 to 120 micrometers. Three flights will be carried out to measure the diurnal variation of earth-limb radiation in the infrared. These will take place at sunrise, noon and sunset. The remaining flights will be designed on the basis of the earlier results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, LOWER IONOSPHERE EM DISTURBANCES

W. Swider, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582810)

AF function - VLF/HF/VHF communications/radar. Deficiency -inability to determine effects of nuclear scenarios and natural disturbances on communications/radar such as VLF (AABNCP), HF (SAC-ROC5-72), VHF (MAC-GOR 3-72), OTH B (TN-ESD-RADC-0401-71-01). Objective - to measure ionospheric D- and E-region parameters during a solar proton event (SPE) in order to develop predictive software for communications/radar systems in natural solar disturbances and general nuclear conditions. How research contributes - payoff is through better predictability of ionospheric disturbances on VLF-HF communications/ radar systems. This will assist both operational and design requirements.

Rocket payloads containing positive and negative ion mass spectrometers, Gerdien condensers, and energetic charged particle detectors will be launched during an SPE, especially around sunrise and sunset periods. Supporting ground-based and satellite observations of opportunity will be incorporated into the program. In this manner, essential parameters will be determined to develop detailed physical-chemical predictive codes describing ionospheric conditions which can be used to determine the effects of ionospheric disturbances of natural/nuclear origin on electromagnetic propagation. Concurrently, laboratory work on significant related chemical processes also will be undertaken.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, UV ELECTRON & PROTON FLUX MEASUREMENTS IN THE AURORAL E-LAYER

R.A. Van Tassel, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584090)

AF function - trans-ionospheric ranging and communications, remote ionospheric monitoring. Deficiency - present state-of-the-art in relating natural optical emission to the electron density profile is not understood well enough to permit remote satellite monitoring of the auroral oval. Objective - in situ measurements with rockets of uv, electron and proton fluxes. How

research contributes - provides direct measurements of atmospheric parameters to correlate with other measurements and computer codes being generated in the auroral-E program.

The approach is to use sounding rockets to measure the following parameters in the auroral E-layer: 1) electron flux and differential energy distributions from 1 eV to 20 keV, 2) proton flux and differential energy distributions from 5 keV to 60 keV, and 3) volume emission rates and total column emission rates from atomic oxygen at 5577 Angstroms, 2972 Angstroms and 1356 Angstroms, from neutral nitrogen in the LBH bands and 2nd-positive bands, from ionized nitrogen at 3914 Angstroms, from hydrogen-beta at 4861 Angstroms, and from the nitrogen dioxide continuum around 5070 Angstroms. All of the measurements will be made from a single rocket payload in the altitude range between 90 and 180 km.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, AURORAL-E COMPOSITION AND DYNAMICS
W.K. Vickery, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584460)

AF function - trans-ionospheric communications, surveillance systems, and remote ionospheric monitoring. Opportunity - potential exists for development of a satellite-borne wide-area remote ionospheric monitoring system to provide environmental support to communications and surveillance systems. Objective - experimentally test models of ionospheric processes to determine if electron density profiles can be accurately determined from remotely sensed optical measurements. How research contributes - rocket-borne experiments will provide the composition and dynamics inputs to the ionospheric models being generated in the auroral-E program.

Ionospheric and neutral composition are being measured by a rocket payload containing a switched ion/neutral mass spectrometer. The payload will also contain an energetic electron analyzer and electron density probe. The neutral atmospheric, neutral dynamics will be measured by a second payload to determine winds, shears, turbulence and turbopause altitude. The mass spectrometer will provide a fairly complete description of the auroral plasma, yielding, above 100km, distributions of all ionic species as well as neutral argon and nitrogen.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, SUNSPOT-FLARE ASSOCIATION
F.W. Ward, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580830)

The determination of the latitudinal and longitudinal motions of sunspot groups and their systematic variations over the course of the cycle of their development. In particular, this study will uncover the systematic differences between the active and inactive portions of the cycle, and any implications related to spot development.

The analysis will consist of the stratification of the data on the occurrence and two-dimensional motions of spot groups from a long and homogeneous record. This stratification will determine the rates of motion as a function of latitude, and the variation of these motions as the focus of activity moves to progressively lower latitudes during the cycle. An attempt will be made to determine the rate at which the underlying physical processes shift with latitude.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, NAVY ENVIRONMENT - DEEP EQUATORIAL MOTIONS IN THE INDIAN OCEAN
J. Luyten, Woods Hole Oceanographic Institution, *Main St., Woods Hole, Massachusetts* 02543 (DN675107; N00014-76-C-0197)

Virtually no information is available on the response of the subsurface waters of the Indian Ocean to the strong, large-scale, long-period forcing exerted by the atmosphere during monsoon events. The principal long-range objective of this work is to understand the deep-ocean response to the seasonal variation of the monsoon regime. The shorter range objective is to provide information on the spatial and temporal scales of variability in the current and sound velocity field near the equatorial region of the western Indian Ocean. This work is part of a large experimental program, Indian Ocean Experiment (INDEX), designed to study the physical oceanographic processes that dominate the dynamics of the near-surface and subsurface motions in that region.

This task involved a pilot field experiment which included deployment and recovery of four instrumented moorings north of the Seychelles Island group (55 degrees E) from early 1976 to December, 1976. The current meter, temperature, and pressure records were used to design a major experiment in 1979-1980, and to develop theoretical models that predict the presence of low-frequency, equationally trapped baroclinic waves in this region. The data from this experiment will also be used to provide descriptive information on the deep-current response to the atmospheric forcing.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0027, NAVY ENVIRONMENT - SELF-IMPLANTED MOORINGS
R.G. Walden, Woods Hole Oceanographic Institution, *Main St., Woods Hole, Massachusetts* 02543 (DN775287; N00014-77-C-0230)

Some limitations in understandng the variability of the oceans for acoustic and oceanographic predictions arise from the cost of fabricating, deploying, and retrieving existing oceanographic mooring systems. Because of recent advances in mooring and electronic technology, it appears feasible to fabricate compact buoy systems that can be dropped from moving ships or aircraft and will deploy without human assistance. This work investigates the feasibility of automatically deploying complex cable systems and a large anchor from a single package.

The investigator will conduct a series of subsystem tests, finalize the system design, and fabricate components for a final series of fully operational tests. Final trials will involve deep-ocean deployments by a cargo aircraft and moving oceanographic ship.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0028, STUDY OF THE ATMOSPHERIC ENERGETICS
E.C. Kung, University of Missouri, Columbia Campus, School of Agriculture, Dept. of Atmospheric Science, *130 Jesse Hall, Columbia, Missouri* 65201 (ATM77-24558)

The objective of this research is to continue a long-term study of atmospheric energetics. The principal investigator has for over a decade systematically analyzed atmospheric observations in an effort to clarify the processes by which atmospheric energy is made available to weather systems and how it is distributed in space and time within those systems. This current work addresses specific areas of study: 1. the energetics of the tropical atmosphere; 2. the maintenance of large-scale circulation systems; 3. problems of large-scale heat budgets; and 4. climatological analysis of atmospheric energy parameters.

These studies will be carried out using observations from several Global Atmospheric Research Program (GARP) data sets that are either now available or will be collected in 1979. In addition, long-time records (1958 to present) from the Northern Hemisphere upper-air data bank will be used.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0029, A PHYSICAL INVESTIGATION OF AREA-OF-EFFECT OF CLOUD-SEEDING IN SIERRA NEVADA
J.A. Warburton, University of Nevada, System Office, Desert Research Inst., *Reno, Nevada* 89507 (ATM78-12215)

Increasing precipitation through cloud-seeding has been demonstrated for certain orographic cloud systems in the Rocky Mountains. The total area affected by such modification has not

been ascertained and represents an important societal as well as scientific issue.

This research seeks to determine whether cloud-seeding on the (California) western slopes of the Sierra Nevada affects the cloud systems sufficiently to provide detectable changes in the precipitation falling on the (Nevada) eastern slopes of the Sierra. An advanced aircraft measurement and sampling system is being used to study changes in the physics of the precipitation process. There are three specific elements of the precipitation physics research: (1) To measure the content of the silver iodide and other ice-nucleating aerosol tracers in the liquid and ice phases within the cloud systems. (2) To investigate the occurrence and persistence of supercooled liquid water passing over the mountain during various stability conditions. (3) To measure the spatial distribution of ice crystal concentrations and habits in relation to vertical mixing and the distribution of liquid water. New equipment has been constructed and installed in the aircraft for the airborne collection of supercooled liquid water and bulk ice crystals needed for the chemical analysis. The field research is being conducted over and on the downwind slopes of the Sierra Nevada and is closely coordinated with the operations of the Sierra Cooperative Pilot Project.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0030, TECTONIC DEVELOPMENT OF WEST ANTARCTICA AND ITS RELATION TO EAST ANTARCTICA

I.W. Dalziel, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (DPP79-20220)

Columbia University will cooperate with the British Antarctic Survey in the planning for and conduct of airborne geophysical remote sensing in the Ellsworth Mountains region of Antarctica. Airborne radio-echo sounding and magnetic surveys will be made as part of a joint scientific study of the tectonics and structural geology of the area, with emphasis on the regions that are covered by deep, permanent glacial ice. The goal of the study is to understand the geological and tectonic history of this part of Antarctica, and in particular the relationship of East and West Antarctica.

No United States scientists will do field work in Antarctica under this grant in 1980-81.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Polar Programs

5.0031, NATURAL AND ARTIFICIAL INFRASOUND AS AN ATMOSPHERIC PROBE

W.L. Donn, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (ATM79-08350)

Interfering ocean waves radiate continuous infrasound into the atmosphere. Also, infrasound is generated during the supersonic part of the many daily flights of the Concorde aircraft. This grant funds the recording of these sounds at long range on arrays of sensors after the signal has been refracted through the upper atmosphere. This remote, inexpensive, passive probe of the atmosphere provides information on the speed and direction of the winds in the stratosphere and lower thermosphere. The continuous signal from sea waves and the regular signal from the Concorde will be digitally recorded to develop a procedure for providing a continuous monitor of the upper atmosphere. The digital analysis will: (1) increase the resolution of wind determinations, particularly when more than one infrasound source is present; and (2) decrease the time required to obtain results in a large-scale operation.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0032, DYNAMICS OF SIMULATED TORNADOES

E.M. Wilkins, University of Oklahoma, Norman Campus, School of Arts & Sciences, Dept. of Meteorology, *660 Parrington Oval, Room 101, Norman, Oklahoma* 73069 (ATM80-02102)

Experiments will be carried out in a laboratory tornado simulator to learn more about certain processes that are associated with tornadoes. It is believed that a better understanding of these processes will lead to improved methods for defending against the tornadoes themselves. The simulator is the well-known Ward vortex generator, famous for its unique ability to reproduce multiple vortex systems and other phenomena known to be characteristic of tornadoes. A primary method of attack is to make accurate quantitative measurements to test or verify theories and numerical models.

Four different experiments are planned: (1) An investigation of the processes and the range of parameters in which turbulent energy may be converted into mean flow energy to increase the intensity of a vortex. (2) A comparison of results of identical experiments in two different simulators in order to test the significance of scaling factors and test for possible simulator-associated anomalies in experimental results. (3) An investigation of surface roughness on the relationship of vortex maximum velocity to central pressure drop. (4) Measurements of pressure and velocity transients associated with the passages of satellite vortices in various configurations of multiple-vortex systems.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0033, THE DEEP DRIFTER - A SIMPLE TOOL TO DETERMINE AVERAGE OCEAN CURRENTS

T. Rossby, University of Rhode Island, Graduate School of Oceanography, *Narragansett, Rhode Island* 02882 (OCE80-10839)

A simple technique will be developed to explore the very-low-frequency (delta months) motions of the oceans. It consists of a freely drifting, neutrally buoyant float which, at the end of a prescribed period of time, surfaces and activates a radio transmitter which can be located to within a few kilometers with the French ARGOS satellite system. These deep drifters will be developed so that they can be used in any ocean basin at any depth for submergence periods of up to several years. They will complement and extend existing techniques for ocean circulation studies. This project will carry out the instrument development and evaluation phase of the effort. A simple pilot experiment in the low-oxygen deep waters off West Africa will be conducted. A full report will be prepared on the test results and field evaluation of the technique will be made.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Ocean Sciences

5.0034, LUNAR HIGHLANDS BRECCIAS

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Work will concentrate on petrologic studies of lunar highlands breccia 73255 and on leadership of interdisciplinary consortium research on this sample. This breccia represents consolidated ejecta from the Serenitatis basin-forming event. Overall aims of the research are to understand the processes that operated in large lunar impacts and to determine the characteristics of the pre-impact linar crust. Studies will concentrate on clasts extracted from breccia 73255. The petrologic research will involve detailed petrography, microprobe analysis, and transmission and scanning electron microscopy studies. Consortium leadership will involve coordination of research in all fields. Also, a collaborative restudy of another lunar breccia (12013, with J.E. Quick and A.L. Albee, California Institute of Technology) will be completed.

Work will also be begun on two broad-scale synthesis studies. One will be a detailed comparative study of the clast suites in all the Apollo 17 fragment-laden melt rocks; aim of this work will be to reconstruct the pre-Serenitatis lunar crust. The other

study will consist of: a) review and evaluation of all data currently available concerning petrology, chemistry and age of the early lunar crust; b) identification of gaps in knowlege; c) research to fill the gaps in knowledge and to formulate hypotheses of petrogenetic processes and history of the early lunar crust.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0035, REMOTE SENSING IN THE RICHFIELD, UT 1 DEGREE BY 2 DEGREES QUADRANGLE FOR CUSMAP
M.H. Podwysocki, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (9790-02252)

STATE TO WHICH PROJECT PERTAINS: Utah.

Complete mapping of limonitic materials from satellite images and field check to determine if limonitic areas are related to hydrothermal and uranium roll-front mineralization.

Relate lineament compilations taken from several scales of satellite images to the geophysical, geochemical, and geologic data and to patterns of limonitic materials in order to define models for localization of mineralization.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0036, RECLAMATION POTENTIALS FOR WESTERN COAL MINES
P.F. Narten, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, *12201 Sunrise Valley Dr., Mail Stop 710, Reston, Virginia* 22092 (I-0002)

STATES TO WHICH PROJECT PERTAINS: North Dakota, Montana, Wyoming, Colorado, Utah, New Mexico, Arizona.

The project is designed to provide an assessment of the potentials for establishing productive, diverse plant communities, composed primarily of native plants, in western coal mining areas.

The study combines reconnaissance examinations of the progress of natural and planned reclamation at 22 western coal mines with literature reviews.

Climatic, landform, overburden, soil, and biological (including vegetational) parameters are examined together with the techniques available to reduce the factors detrimental to reclamation. The various approaches of mining companies to reclamation are also discussed. Observations at 22 coal mines in North Dakota, Montana, Wyoming, Colorado, Utah, New Mexico, and Arizona are compared. The results will be presented in a Geological Survey publication.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office

5.0037, A STUDY OF THE ARCTIC ATMOSPHERIC BOUNDARY LAYER
E.D. Leavitt, University of Washington, Div. of Marine Resources, Polar Science Center, *Seattle, Washington* 98105 (DPP78-16613)

The proposed research will investigate the form drag of pressure ridges in the ice cover of the Beaufort Sea. Knowledge of the form drag is important because experiments and modelling results suggest that form drag accounts for a large fraction of the total air stress exerted on the pack ice.

The project will have two objectives: the first is to parameterize horizontal wind spectra as a function of air stress and stability, and the second is to study variations in the geostrophic drag coefficient and fractional relationships in the angle between the geostrophic wind and the surface stress.

The data necessary for the proposed research were collected as part of the Arctic Ice Dynamics Joint Experiment (AIDJEX). The data set includes six levels of winds computed from pilot balloon ascents, inversion heights as monitored by an acoustic echo-sounder, and observations of the surface pressure field suitable for computation of the geostrophic velocity.

No field work is involved in the project.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0038, TROPO-STRATO TIDAL INVESTIGATION
G.V. Groves, University of London, University College, *Gower St., London, England, United Kingdom* (DF582080; AFOSR-77-3224)

AF function - prepare environmental assessments of systems that may contribute to the pollution of the stratospheric environment. Opportunity - improvement of an understanding of the dynamics of the stratospheric processes. This work will identify sources of dynamic motions in the stratosphere. Objective - interpretation of atmospheric tidal patterns to define the tropospheric and stratospheric generating sources. How research contributes - better understanding of stratospheric dynamics will allow more accurate prediction of the horizontal and vertical extent of the growth of pollutants injected into the stratosphere, their persistence and transport mechanisms. An accurate understanding of stratospheric dynamics is essential to the preparation of inputs for environmental impact statements.

Observational data from diurnal rocket grenade experiments will be analyzed for short-term variations in tidal patterns. General theory and analytical techniques will be developed to enable the sources of generation from observed tidal patterns. This is a complex inverse problem of the well-developed classical Chapman-Lindzen tidal theory. Specific investigations will include (a) the propagation of atmospheric tides by specified sources of generation (such as heating), (b) the resolution of diurnal and semi-diurnal components from wind and temperature observations, and (c) deducing the properties of generation sources by working back from observed tidal motions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, RESEARCH OF BIOENGINEERING PROBLEMS MEDICALLY SIGNIFICANT TO ARMY AVIATION
J.L. Haley, U.S. Dept. of Defense, Army, Medical Research & Development Command, Aeromedical Research Lab., *Fort Rucker, Ozark, Alabama* 36362 (DA0D6735)

To provide valid, meaningful biomedical criteria for the development of improved designs and equipment for head protection, the means to assess helmet protective performance, and prevention of post-crash fire burn by improved thermal protective clothing.

The approach will be based on sound and accepted experimental bioengineering methodologies, including mathematical modeling, pathophysiologic techniques, biomechanics, structural engineering, thermodynamics, and physics.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0002, BIOMEDICAL APPLICATION & HEALTH HAZARD ASSESSMENT OF OXYGEN ENRICHMENT BREATHING SYSTEMS (DA0C6899)
R.N. Armstrong, U.S. Dept. of Defense, Army, Medical Research & Development Command, Field Research & Biomedical Applications Div., *Fort Rucker, Alabama* 36362 (DA0G0169)

To identify, assess, and prevent unnecessary health hazards associated with the flight environment and to obtain a biomedical data base on the human function associated with the use of aircraft oxygen enrichment breathing systems in the flight environment. To provide the Army data, information, recommendations and criteria to aid in the development and deployment of life support systems to alleviate identified health hazards.

The approach will consist of a biomedical evaluation of state-of-the-art oxygen enrichment breathing systems during air-

craft ground and flight conditions. The evaluation will include the sampling of the environmental air input to the system as well as the system output-enriched air. The samples will be analyzed to determine the systems' ability to effectively filter contaminates known to exist in the operational environment. Physiological data, heart rate, oxygen tension and respiratory functions as well as system parameters, oxygen concentration, flow rates, temperatures and pressures, will be collected during ground operations and aircraft flight at altitude to assess the ability of the system to provide aviators the required oxygen concentration and purity during various flight profiles. The data collected will be evaluated with respect to biomedical, safety, and man/machine limitations.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0003, STRESS AND PERFORMANCE IN THE FLYING TRAINING ENVIRONMENT

Kvahenbaul, Arizona State University, Graduate School, *Tempe, Arizona* 85281 (DF224200; F33615-78-C-0053)

To investigate stress in the flying training environment with particular interest directed to stress of simulated flight and subsequent stress of airborne events. Experiments have been planned which (1) allow for quantification of stress experienced in various modes and phases of surface attack training, (2) help determine the interaction of instructor iques and student stress, and (3) provide a clearer picture of the relationship between stress, learning and performance in surface attack training.

Three studies will examine (1) physiological indices of stress in A-10 surface attack training, (2) the effect of IP teaching style on student stress, and (3) the effect of combat experience on stress response to simulated A-10 scenarios.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0004, FORCE-CUE REQUIREMENTS FOR AIR-TO-SURFACE WEAPONS DELIVERY SIMULATION

R.B. Brooks, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF224460)

The purpose of this research is to evaluate effects of two different simulator force-cueing modes (i.e., six-degrees-of-platform motion versus g-seat/g-suit stimulation) upon the training of A-10 conversion and air-to-surface weapons delivery tasks. If simulator force-cueing can be shown to have minimal effects upon pilot training, or if necessary force-cues can be generated by simple and inexpensive methods (g-seat or g-suit), reductions in the life-cycle costs of A-10 simulators would be realized. ASPT's platform motion system has recently undergone modifications which will increase the iteration rate by a factor of four. This means that the motion, visual, and g-seat cues will be provided to the subject more rapidly and realistically than was possible in the past.

A transfer of training study will be conducted using recent UPT graduates as subjects. The flying tasks will be taken from two categories of A-10 maneuvers - conversion training and air-to-surface training. The subjects will fly these maneuvers in the A-10 ASPT (where automated performance measures and weapons delivery scores will be recorded) and in the actual A-10 aircraft (where instructor-pilot ratings of flying performance and gunnery range scores will serve as criteria). For the ASPT portion of the study, the two conditions of force-cues will be (1) six-degrees-of-platform motion ON, g-seat and g-suit OFF, and (2) six-degrees-of-platform motion OFF, g-seat and g-suit ON. Two aspects of performance are of interest: rate of skill acquisition and final level of proficiency attained. A-10 ASPT performances will be compared with aircraft performances to determine the relationship between flying skills exhibited in the two systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0005, SKILL DEGRADATION

J.C. Demaio, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223340)

To monitor the decline in performance on a high-fidelity aircraft simulator during extended periods of non-practice.

Pilots currently in non-flying jobs will be used as subjects. Subjects will be trained to a predetermined performance level on the advanced simulator for pilot training (ASPT). Rechecks will be conducted in ASPT after varying levels of non-practice to determine rate of skill degradation. The performance will be evaluated in respect to such pilot factors as amount of flying time, type of aircraft flown, and most recent aircraft currency.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0006, EFFECTS OF POLLUTANTS ON VERTEBRATE CELLS IN VITRO

M.W. Berns, University of California, Irvine Campus, School of Biological Sciences, Dept. of Developmental & Cell Biology, *Irvine, California* 92664 (DF046230; AFOSR-77-3136)

AF function - the Air Force uses many unique chemicals and materials to obtain optimum performance for its aircraft and missiles. These chemicals and materials or their by-products impact on the surrounding environment with varying degrees of severity on both a short- and long-term basis. Legislative and regulatory controls mandate that the Air Force is responsible for assessing and controlling pollution in its operations. Deficiency - there is a need to develop a rapid and sensitive assay system for pollutants and to elucidate the basic mechanisms of biological action of these compounds. Objective -the purpose of this research is to develop in vitro an assay system for the evaluation of various environmental pollutants while obtaining a basic understanding of some of the mechanisms of agent action at the cellular level. How research contributes - the research directly supports subarea 1.9, 'Environmental Protection and Toxicological Hazards.' Results could lead to controlled usage of known harmful agents and development of agents that have the same operational efficiency but with minimal biological effects.

Growth studies will be conducted using MMH and UDMH on various vertebrate cells in culture, including two diploid human cell cultures. Examination of sister chromatid exchanges following exposure to hydrazines will also be done. Scanning electron microscopy will be used to study alterations in cell surface caused by hydrazine compounds.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0007, TRAINING FOR AIR-TO-AIR TARGET ACQUISITION

J. Bloomfield, Honeywell Inc., *2600 Ridgeway Pkwy. N.E., Mail Station MN17-2367, Minneapolis, Minnesota* 55413 (DF325370; F33615-79-C-0615)

Devise and develop training procedures for those required to perform air-to-air target acquisition to increase acquisition distance and thereby improve performance and increase safety. Present understanding of search in a large unstructured field is not sufficient to identify exceptional pilots, nor is it sufficient to train pilots to improve their search ability. The results of this contract will aid achievement of both of these goals. This will be accomplished through a two-phase effort.

Phase I will consist of analysis of the problem, development of the test task and development of training procedures, resulting in an interim technical report detailing the essential components of air-to-air target acquisition and the proposed training methods for each component. Essential components will include, but will not be limited to, search patterns, empty field myopia and peripheral acuity. Phase II will consist of training observers using selected methods and analyzing the results, culminating in a final report detailing the training procedures used and their evaluation, suggestions of theoretical mechanisms and applicability of methods to operational conditions.

SUPPORTED BY U.S. Dept. of Defense, School of Aerospace Medicine, Clinical Sciences Div.

6.0008, DYNAMIC FIDELITY TESTING OF AIRCREW TRAINING SIMULATORS

P. Sikorski, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DF228710; F33615-78-C-0064)

This effort will attempt to provide rational, integrated answers to the following questions: (a) What are the essential objective qualities for which a training simulator should be tested? (b) What are the tests that should be conducted to determine the levels of these qualities? (c) How should the test results be evaluated and integrated? (d) How can these results be used to correct simulator deficiencies?

A master generic (nonmilitary) specification system will be developed for application to training simulators for gas turbine-driven aircraft of the non-rotary-wing/non-VTOL type. All effects, mechanical, visual and aural, contributing to the objective dynamic fidelity of a simulator will be considered. Standardization and relative independence from training requirements will be sought, taking into account the overall criteria of rationality, reliability, versatility, compatibility, diagnostic power, cost-effectiveness, and timeliness, as applicable. Cognizance will be taken that the objective evaluation of a simulator is a multiple-criteria problem involving criteria that are not necessarily either commensurable or wholly independent of one another. The system will be structured to permit efficient computerization and later expansion to encompass ground-handling qualities, VTOL aircraft characteristics, etc.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0009, GROUND-REFERENCED VISUAL ORIENTATION WITH IMAGING DISPLAYS

S.N. Roscoe, New Mexico State University, Las Cruces Campus, School of Arts & Sciences, Dept. of Psychology, *University Park, Las Cruces, New Mexico* 88003 (DF056560; AFOSR-80-0024)

AF function - all computer-generated, sensor-generated, and optically generated displays that present synthetic images of the outside world have the common characteristic of producing systematic errors in size and distance judgments. Deficiency - although the correction needed for any given system and for each individual using a system can be readily established empirically by a simple psychophysical experiment, determination of the causes of the constant perceptual errors presents an elusive problem as does the identification and quantification of the independent variables that affect their magnitude. Objective - the research will correlate perceptual and oculomotor responses to variations in the visual scene, specifically in the distribution of resolvable texture surrounding centrally presented target objects, in the performance of tasks involving judgments of size and distance as encountered in flight operations. How research contributes - a complete understanding of variables contributing to biased size and distance judgments and their individual influences would allow general rules rather than specific tests to guide engineers in designing systems. Such understanding would also provide a basis for formulating testable theories of the visual perception of distance.

The technical approach involves the review of current research findings, systematic refinement of a model of the oculomotor functions of the eye that will eventually account for the host of unexplained findings in the judgment of the sizes and distances of objects in the visual scene, and a program of experimentation to establish quantitative functional relationships among perceptual departures from the law of size constancy and the accommodation of the eye to distances other than that of the object to be judged, as indicated by measuring the curvature of the anterior surface of the lens by the use of an infrared optometer and by the use of various other optometric devices, and by means of electrocortical measurement devices.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0010, CARDIOVASCULAR, RENAL AND RESPIRATORY EFFECTS OF HIGH INTENSITY, INTERMEDIATE DURATION, LOW-FREQUENCY VIBRATION

J.F. Cornhill, Ohio State University Research Foundation, *1314 Kinnear Rd., Columbus, Ohio* 43212 (DF049720; AFOSR-77-3411)

AF function - AF operational personnel are subjected to a number of environmental stresses, one of which is vibration. With an increasing number of missions in high-performance aircraft at low altitudes, crew members will be exposed to significant levels and durations of low-frequency vibrations. Deficiency - the circulatory system is one of the mammalian systems most affected by vibration; of particular interest is the influence of vibration on the transport of certain blood elements to and across the vessel walls and the effects on renal function. For example, if cholesterol transport to the arterial wall is enhanced and/or if renal function is impaired this would have significant implications on long-term health problems of exposed personnel. Objective - three major objectives have been identified: (1) continued development of the television-computer scanning technique will be carried out with the hope of having an extremely accurate and reproducible technique available within the first six months of the proposed project; (2) the basic mechanism of transport of material to the arterial wall under conditions of acute whole-body vibration will be studied; and 3) on the basis of the acute experiments, an optimized chronic study of the effect of low-frequency whole-body vibration on the deposit of cholesterol in the aorta will be carried out. How research contributes - this research supports objectives identified in AFSC R0 1.8, 'Aircrew Safety and Effectiveness in Mechanical Force Environments' and RO 1.5, 'Aerospace Medicine'.

The pulsed ultrasonic Doppler will be employed to study the effect of chronic whole-body vibration on the arterial wall, and a television-computer scanning technique will quantify atherosclerotic lesions resulting from whole-body vibration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0011, CREW SAFETY ASSESSMENT FOR AIR COMBAT FIGHTER (F-16)

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The F-16 aircraft incorporates new crew station design innovations to improve pilot performance under combat conditions. These innovations include an ejection seat reclined at 30 degrees back-angle to improve performance under high-maneuvering-acceleration and a polycarbonate canopy without a conventional windshield structure. The canopy does not obstruct the pilot's vision in the area forward of the ejection seat headrest. The objective of this effort is to evaluate the performance of the F-16 ejection seat by review of rocket sled-test data and to evaluate the crew injury potential associated with bird impact on the aircraft canopy. Assessment of the effects of inadvertent canopy loss on the pilot's ability to control the aircraft or initiate ejection is studied under work unit 72310655.

Assistance will be provided in preparation of a test plan for demonstration tests of the S111S-3 ejection seat using the rocket sled at Holloman AFB. Consultation will be provided on development of test data processing. Acceleration data recorded during the ejection tests will be analyzed to determine compliance with the acceleration limit criteria that have been provided in MIL-S-9479B. A test plan will be developed to evaluate the F-16 canopy's bird-strike protection capabilities. Impact exposure criteria will be developed using available biotechnology data. A special test rig will be designed and fabricated to measure the forces and moments acting on a helmeted head form during bird-strike tests at the Arnold Engineering Development Center. The testing and data analysis will be accomplished under a memorandum of agreement between the Air Force Flight Dynamics Laboratory, the Materials Laboratory, the Aerospace Medical Division and the F-16 System Program Office.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

6.0012, CONCEPTUAL DESIGN AND MODIFICATION OF HUMAN IMPACT RESEARCH FACILITIES

J.A. Brown, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321460)

The success of research to define human exposure limits to emergency escape and aircraft crash environments and the development of design and evaluation criteria for personnel protective equipment in these environments is dependent upon the availability of adequate impact test facilities and equipment. The facilities must be capable of producing and measuring the complex acceleration-time histories that are experienced in USAF operations. Furthermore, they must be designed to meet the unique safety requirements associated with the use of volunteer subjects. The objective of this effort is to plan, design and/or modify impact test facilities and test fixtures required by experimental designs to meet USAF technology needs and operational safety requirements.

The capabilities of existing facilities and test equipment are assessed by test and analysis. Requirements for future research programs are studied to determine if these requirements can be met by existing equipment or by modification of this equipment. If new designs are required to meet the requirements, the design is developed through the conceptual phase and procurement specifications and plans are prepared and implemented. Operational performance capabilities and reliability of new and existing facilities are documented for review by laboratory engineering safety and human use committees. New instrumentation and data processing techniques are continuously investigated to improve measures of biodynamic responses and overall measurement accuracy.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

6.0013, TOXIC HAZARDS RATING OF AIR FORCE NONMETALLIC MATERIALS

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To determine the physical and chemical behavior of AF nonmetallic materials, plastic waste and surplus organic compounds under a variety of conditions to ascertain their potential toxicity (when utilized in confined habitable spaces), and to identify the environmental pollution impact from their disposal by incineration. To establish thermal profiles for safe utilization of synthetic polymers in confined, habitable spaces. To identify and quantitate thermal degradation products under pyrolytic and oxidative conditions, and to investigate kinetic parameters for thermal decomposition reactions of nonmetallic materials. To determine the toxicological impact of nonflammable fibrous materials used in Air Force aeronautical systems, during routine service conditions and in emergency crash situations. To perform toxic hazard evaluations of these data as they relate to operational exposure of AF personnel and/or environmental impact of use and disposal of such materials. This work is requested by AFSC Laboratories, ASD, SAMSO, and AFLC.

Thermogravimetry is used to study physical and chemical stability as well as thermal degradation reaction rates of AF nonmetallic materials. Various heating rates and sample environments are employed. For quantitative determination and identification of individual thermal breakdown products, combinations of the simultaneously performed analytical techniques of thermogravimetry (TG), gas chromatography (GC), and mass spectrometry (MS) (TG/MS, TG/GC/MS) are employed. Pyrolysis studies allowing very fast heating rates are carried out also in combination with gas chromatography and mass spectrometry to supplement degradation data. Additional analytical methods such as direct probe mass spectrometry, cryogenic trapping and infrared spectrometry are used as deemed necessary.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Toxic Hazards Div.

6.0014, OPTICAL PROPERTIES OF WINDSCREENS

L.V. Genco, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321110)

To develop new measurement techniques for evaluating cockpit windscreen optical characteristics. To measure and quantify the optical characteristics exhibited by experimental and actual aircraft windscreens, using both existing and new optical measures. To analyze the optic performance of the design windscreens for the F-111 using computer ray-tracing techniques, assist in relating the optical characteristics of these, and similar, transparencies to specific functional effects on the human visual system (work unit 71841803). The ultimate product of this work unit will be to recommend a specific set of optical measures that will be used in acceptance testing of aircraft windscreens.

Historically, a number of optical tests have been devised in an effort to quantify the optical characteristics of windscreens. None of these measures has proven to be infallible. In the previous work unit (71841204) several new measures of windscreen optical quality were being explored. These included multiple imaging, optical Fourier analysis, angular deviation, binocular disparity and birefringence coloration. By comparing optical measures made on the windscreens with pilot acceptance and/or visual performance (work unit 7184-18-03), it will be possible to determine which of these optical tests correlate with vision. Predistorted panels have been fabricated to be used in relating optical measures to vision. Windscreens and new panels having different characteristics and geometries will be used during the course of this work. The windscreen measurement lab. and the image metrics facility will be used in accomplishing this work. Disciplines involved are optics, physics, and experimental psychology. Field data from F-111 windscreens will be obtained and compared with the optical measures developed for the previous work unit. Computer ray-trace of the F-111 windscreen will be accomplished for determining design-inherent angular deviation, binocular disparity and multiple imaging. This will be compared with actual measures to determine how much of the problem is due to manufacturing and how much is inherent in the design.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Human Engineering Div.

6.0015, CONSULTATION ON TOXIC ECOLOGICAL EFFECTS AND ENVIRONMENTAL IMPACT

C.B. Harrah, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF320480)

The objectives of this effort are (1) to assist users of Air Force chemicals with interpretation of data related to the ecological aspects of their operations, (2) to lend technical assistance and provide professional advice to organizations preparing environmental impact statements or assessments, (3) to assist the Surgeon General in responding to requests for review of criteria documents from NIOSH and EPA, and (4) to maintain contact with academic institutions, industry, and other governmental agencies in order to keep abreast of the state-of-the-art in environmental research.

To provide technical and professional advice to any Air Force organization preparing environmental impact statements or assessments when chemical pollution is a major concern. Close liaison will be maintained with EPA to keep abreast of environmental quality standards and criteria requirements. When the National Academy of Sciences establishes its board on environmental quality, continuous contact will be established for assistance in setting environmental quality standards.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Toxic Hazards Div.

6.0016, DEVELOPMENT OF A SENSITIVE PERFORMANCE TASK FOR THE DES

R.E. Van Patten, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325710)

The objective of this study effort is to provide a set of recommendations for the characteristics of a performance task which captures the multidimensional essence of pilot work load in air combat maneuvering and in air-to-ground attack with sufficient sensitivity to elicit pilot performance changes under the influence of acceleration stress, possibly combined with thermal stress and the effects of chemical warfare mimetic agents.

Time-motion study and other industrial engineering techniques will be applied to develop a plan for collection and analysis of data collected during a limited demonstration of a car-

diovascular disease reduction program (heart program, demonstration phase). Methods of extrapolating these analyses to any AF base will be developed.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

6.0017, REPRODUCTIVE HAZARDS OF INDUSTRIAL COMPOUNDS

B. Hardin, U.S. Dept. of Health & Human Services, Public Health Service, Center for Disease Control, National Inst. for Occupational Safety & Health, Division of Biomedical & Behavioral Science, *4676 Columbia Pkwy., Cincinnati, Ohio* 45226 (VOO-C24-370)

Reproductive failure, congenital malformations, and metabolic diseases can result from induced mutations in germ cells. Priority chemicals, selected on the bases of usage and extent of exposure, will be screened for potential reproductive hazard via germ cell mutations. Selected chemicals are vinyl toluene (a copolymer used in paints and varnishes - 46,000 workers exposed), acrolein (a chemical intermediate and jet fuel additive - 7,500 workers exposed), n-butyl acetate (a lacquer and perfume solvent - 1.8 million workers exposed), organic peroxides (produced in volumes exceeding 4 million pounds annually), ethylene and propylene oxides (high-volume chemicals used as chemical intermediates in the textile and plastics industry), and ethylene oxide as a dry sterilant (125,000 exposed to ethylene oxide, 90,000 exposed to propylene oxide), diesel exhaust/coal particulates, ethyl benzene (a chemical intermediate and solvent produced in annual volumes of approximately 5 billion pounds), and ethoxyethanol (a solvent to which over 237,000 workers have been exposed).

Acrolein, n-butyl acetate, organic peroxides, vinyl toluene, and diesel exhaust will be tested using the Drosophila sex-linked recessive lethal assay. Ethyl benzene, ethoxyethanol, diesel exhaust, and ethylene oxide will be investigated using the dominant lethal test. Ethoxyethanol, diesel exhaust, ethylene oxide, and propylene oxide will be tested in the sperm-head morphology assay; and an effort will made to correlate dominant lethal and sperm-head morphology test results. These projects represent a continuation of prior-year efforts in which 7 chemicals have been tested in one or more of these test systems.

A review of literature on the male reproductive system will be made to identify factors which might be developed into useful indices of male reproductive function or dysfunction. A future research goal is the use of information identified in this literature review to develop new animal test systems for male reproductive performance.

SUPPORTED BY U.S. Dept. of Health & Human Services, Center for Disease Control, National Inst. for Occupational Safety & Health

6.0018, ELECTRORETINOGRAM (ERG) IMPLICIT TIME 16272-L

J.B. Siegfried, Pennsylvania College of Optometry, Graduate School, Dept. of Physiology, *Philadelphia, Pennsylvania* 19141 (DA0G9078; DAAG29-79-C-0103)

To elucidate the region or regions in the human visual system that account for the long time constants of the blue color system. Relevance - related to night vision processes where exposure to white and yellow flashes interferes with red and green systems. Will apply to pilots and aircraft controllers in night operations.

A two-color increment threshold paradigm will be used in addition to electroretinogram (ERG) measures of amplitude and implicit time of test flash luminances close to psychophysical increment thresholds. Foveal test flashes will be superimposed on steady, peripheral adaptation. Computer signal to noise-enhancement will be used.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

6.0019, SELECTION FOR PILOT TRAINING

H.E. Jensen, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF234200)

OBJECTIVES: 1. Norming of AFQGT. 2. Investigation of new measures to be used in pilot selection. 3. Validation of AFOQT, PAPAMS, and experimental measures against UPT, CCTS, and operational performance. 4. Identification of characteristics of superior pilots. 5. Evaluation of the effect of the Flight Screening Program on UPT performance.

AFOQT will be normed on AFA, AFROTC, and OTS samples. New perceptual and psychomotor measures, including the Portable Automated Pilot Aptitude Measurement System (PAPAMS), will be investigated to determine their relationship to performance in UPT, CCTS, and operational settings. Phase I: AFOQT-N and APD norming study evaluation of flight screening program. Phase II: experimental testing program. Phase III: collection of criterion performance data through UPT, CCTS, and after one year in an operational setting.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0020, USAF HEARING CONSERVATION PROGRAM

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Many USAF weapon systems and support operations represent potential risks to the hearing of both military and civilian personnel. Loss of highly trained personnel and compensation for hearing loss continue to be major AF problems. The primary objective of this effort is to monitor the USAF Hearing Conservation Program, specifically as defined in AFR 161-35. The prevention of noise-induced hearing loss among AF members requires that these personnel be included in a comprehensive hearing conservation program and the purpose of this research is to guarantee that the multifarious elements of the program are effective. Also, research will be performed to validate auditory risk limits, determine the effectiveness of personal ear protection devices and noise control measures, and insure adequacy of criteria and procedures for disposition of noise-exposed personnel who demonstrate shifts in hearing. Many aspects of the R&D efforts have potential for direct operational support of hearing conservation programs in the field. The tasks described in the Management Review, May 1-2, 1978, along with the milestone elements can be defined and transferred to OEHL. This work will then continue as a pure R&D effort.

AF forms 1490/1491 and associated documents received at the USAF Hearing Conservation Data Registry will receive quality control and then be processed by automated techniques. Computer readouts on a routine basis will be used to continually appraise and evaluate the effectiveness of the overall hearing conservation program. The effectiveness of different elements (military or civilian) at a single base will be continually appraised. Instrumentation utilized in monitoring audiometry, personal ear protection, and disposition procedures for personnel who demonstrate shifts will be assessed on a continuing basis. Methods and techniques used to monitor individuals exposed to potentially hazardous noise will also be continually evaluated and deficiencies, once identified, will be carefully studied so that corrective action(s) can be recommended. Auditory acuity of various groups and subgroups of personnel who work in noise will be studied. Recommendations for correction of problem areas will be made to command surgeons and HQ USAF/SGP, as appropriate. Current plan is for OEHL to acquire all aspects of operational support (MFP8) by March, 1980. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, School of Aerospace Medicine, Clinical Sciences Div.

6.0021, USE OF A LAMINAR FLOW ISOLATOR TO CONTROL INFECTION IN BURNED TROOPS (44)

W.F. McManus, U.S. Dept. of Defense, Army, Medical Research & Development Command, Clinical Div., *Fort Sam Houston, San Antonio, Texas* 78234 (DA0G6976)

It has been well known in recent years that the development of infection has been the most common cause of death in

burned soldiers. As the vast majority of these cases results from invasive infection of the burn wound, methods of reducing burn wound contamination would be expected to result in improved survival. In addition, studies have shown that cross-contamination colonization causes more invasive burn wound infections than auto-contamination colonization. These facts generated interest in the use of laminar air flow isolator units as part of burn care.

The SCI-MED Company of Minneapolis, Minnesota, was contracted to develop a laminar air flow unit to meet certain specifications. Following initial temporary installation, initial testing, and initial patient trials, numerous modifications and new developments were thought to be necessary and were undertaken. These have been completed, and the unit is now installed in its permanent form. Comparison of burn wound microbiology between laminar flow and conventionally treated patients will be made and related to septic complications and mortality in both groups.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Inst. of Surgical Research

6.0022, THE EFFECT OF HIGH Gz ON SYMPATHETIC NERVOUS ACTIVITY

M.G. Ziegler, University of Texas, Medical Branch at Galveston, School of Medicine, Dept. of Pharmacology & Toxicology, *300 University Blvd., Galveston, Texas* 77550 (DF324440; F33615-79-C-0601)

To quantify the sympathetic nervous activity in animals and man relative to exposures to plus-Gz. These data will be used to establish g-limits for pilots of high-performance fighter aircraft.

Several experiments will be conducted at the USAF School of Aerospace Medicine in which human and animal subjects will be exposed to various levels and durations of g. Norepinephrine (NE) and epinephrine (E) in serum and heart tissues will be measured and related to various g environments. These data will be related to serum levels of head trauma victims known to have cardiovascular involvement. These correlations will be used to establish g-limits for pilots flying high-performance fighter aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0023, ADVANCED HELMET-MOUNTED SIGHT (AHMS)

A.R. Deruyck, Polhemus Navigation Sciences Inc., *Burlington, Vermont* (DF322380; F33615-77-C-0513)

To design, develop and fabricate a laboratory-grade advanced helmet-mounted sight (AHMS) system that will provide six-degrees-of-freedom position information of a subject's helmet in suitable output format necessary for integrating it into the visually coupled airborne system's simulator (VCASS) program. Two additional objectives of this program are to develop a suitable integration of the AHMS system with state-of-the-art wide field-of-view (FOV) side-mounted helmet-mounted display (HMD) optics and cathode ray tubes (CRT) and to develop a long-range multiplexed AHMS system which will allow resolution of helmet position and attitudes at distances far greater than those required in high-performance aircraft.

This effort will be divided into four phases: (1) conceptual design phase, (2) detailed design and fabrication phase, (3) test phase, and (4) engineering support phase. Each of these phases shall concentrate on four major areas of development: (1) primary AHMS hardware and programming, (2) hardware and programming for the long-distance multiplexed AHMS (LAHMS), (3) hardware and programming necessary to provide integrated HMD/AHMS (HAHMS), and (4) system electronics processing and control circuitry. Each phase has predetermined goals which must be met in each of these four areas before work can proceed into the next phase. Finally, sufficiently severe testing is performed in characteristic environments to assure that VCASS requirements are met and that system viability for a follow-on airborne-qualified system is achieved.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Human Engineering Div.

6.0024, RESEARCH AND DEVELOPMENT OF HAZARDOUS/TOXIC WASTE ANALYTICAL SCREENING PROCEDURES

R.E. Snyder, Atlantic Research Corp., *5390 Cherokee Ave., Alexandria, Virginia* 22314 (DA0P7897; DAMD17-78-C-8075)

To conduct laboratory experiments that will lead to the development and evaluation of quantitative or, at least, semi-quantitative analytical procedures in kit form for hexavalent chromium, arsenic, mercury, cadmium, copper, lithium, lead, tin (salts only), zinc, cyanide, explosives and flammables.

A literature search will be conducted to identify suitable established analytical methods. These will then be adapted to analyze sludges for the presence of the chemicals of interest. The precision, accuracy and specificity of the methods will be determined.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Medical Bioengineering Research & Development Lab.

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, TWO-DIMENSIONAL MESH ADJUSTMENT ALGORITHM

C.M. Ablow, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DF048310; F49620-77-C-0114)

AF function - design of aerospace vehicles, study of nuclear weapons effects. Deficiency - the computation of functions with sharp variations requires small finite difference intervals for accuracy for certain regions while in other regions large intervals are needed for economy of computer time. Numerical techniques which eliminate or reduce the loss of accuracy due to mesh irregularity are needed. Objective -this research will investigate the use of a uniform mesh in a transformed coordinate system that expands the boundary layer in fluid flow problems. Extension of one-dimensional techniques to 2-d will be studied. How work contributes - techniques which may offer a reduction in storage in the computer with the same accuracy may be obtained.

This effort will attempt to establish a transformation of coordinates that facilitates the finite difference solution of partial differential equations in two dimensions. Analytical efforts will be spent to define the most campylotropic coordinate system for the solution of the PDEs. A rearrangement of the two-dimensional equations into uniquely solvable form will be derived. Methods for the approximation of the derivatives by finite differences and solving the resulting algebraic system will be explored. Questions on the range of applicability of the methods developed will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0002, MHD FLOW COMPUTER STUDY

D.A. Oliver, S T D Research Corp., *P.O. Box C, Arcadia, California* 91006 (DN775787; N00014-77-C-0574)

This objective is to conduct an analytical computer study of explosively driven MHD generators.

The multidimensional computer codes developed at STD Research Corporation will be modified and enhanced to treat high-magnetic Reynolds number flow. A range of experimental conditions and configurations will be modeled. Results will be compared with experimental measurements obtained in a separate program at STD Research Corporation and from other MHD experiments.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0003, GENERAL RELATIVITY AND COSMOLOGY
R.K. Sachs, University of California, Berkeley Campus, School of Letters & Science, Dept. of Mathematics, *Berkeley, California* 94720 (PHY79-13146)

Research in theoretical gravitational physics initiated under NSF grant PHY77-1519A01 will be continued. Among the topics to be investigated are 1) inhomogeneous cosmologies, and 2) particle production in cosmological models.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

7.0004, METHODOLOGY FOR NONLINEAR MODELS OF NAVAL SYSTEMS
R.K. Mehra, Scientific Systems Inc., *1640 Massachusetts Ave., Cambridge, Massachusetts* 02138 (DN775020; N00014-76-C-1024)

Many naval problems including aircraft at high angle of attack are represented mathematically by nonlinear systems. Presently, the mathematical techniques for addressing such problems are specialized and inadequate. This task will develop new methodology for nonlinear systems, particularly for use in control and identification.

Research will be conducted on a number of topics in nonlinear systems, including bifurcation analysis and catastrophe theory, nonlinear system identification, optimal input design and robustness analysis.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0005, PROPERTIES OF AN ORDER-THEORETIC MODEL FOR CLUSTER ANALYSIS
M.J. Janowitz, University of Massachusetts, Amherst Campus, School of Natural Sciences & Mathematics, Dept. of Mathematics & Statistics, *Amherst, Massachusetts* 01002 (DN975680; N00014-79-C-0629)

The objective is to improve the Navy's capability to detect, identify and classify remotely sensed objects by creating and developing improved cluster analysis techniques.

Research will be performed to develop the mathematical and statistical properties of an order-theoretic model for cluster analysis. In particular, the research work includes (a) development and implementation of various clustering techniques associated with the model, (b) axiomatic development of similarity measures, and (c) development of classification structure of cluster methods according to their compatibility with respect to certain mapping characteristics.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0006, EFFECTIVE BEHAVIOR OF COMPOSITE MATERIALS
G.C. Papanicolaou, New York University, Washington Square & University College of Arts & Sciences, Dept. of Mathematics, *100 Washington Sq. E., New York, New York* 10003 (DF055930; F49620-79-C-0153)

AF function - aerospace vehicle design and directed-energy weapons. Opportunity - newly developed mathematical techniques promise better engineering models. Objective - to exploit and understand effects of random inhomogeneities. How work contributes - through more realistic yet solvable mathematical models.

Mathematical techniques from stochastic-asymptotic and nonlinear analysis will continue to be used to address boundary and interface properties of composite, amorphous and porous structures and high-intensity nonlinear beams. The latter area will include the study of modulation equations using the inverse spectral transform, three-dimensional phenomena for electromagnetic beams, and the effects of random media on beam structure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0007, NUMERICAL METHODS FOR FREE-BOUNDARY PROBLEMS AND TWO-PHASE FLOWS 16792-M
G.J. Fix, Carnegie Mellon University, Mellon College of Science, Dept. of Mathematics, *4400 5th Ave., Pittsburgh, Pennsylvania* 15213 (DA0G2073; DAAG29-80-C-0081)

To continue the development and analysis of numerical methods for transonic flow problems and to study a new procedure for free-boundary problems involving two-phase flow. Relevance - the transonic flow work is of interest in areas such as the mechanics of flight vehicles, including rotor craft and ballistics of projectiles. There is also interest in regard to two-phase flows occurring in interior ballistics calculations.

The transonic analysis will employ Kelvin-Bateman-type variational principles with appropriate finite element approximations. Free-boundary problems will be handled by phase-field variational methods based on a Helmholtz free-energy functional.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

7.0008, STABILITY ANALYSIS OF THE LOWER BRANCH SOLUTIONS OF THE FALKNER-SKAN EQUATIONS IN COMPRESSIBLE FLOW
G.R. Verma, University of Rhode Island, School of Arts & Sciences, Dept. of Mathematics, *Kingston, Rhode Island* 02881 (DF058210; AFOSR-80-0150)

AF function - advanced aerospace vehicles. Deficiency - an inadequate state of knowledge exists relative to transition to turbulence in boundary layers. Objective - to determine the instability of laminar, separated boundary layer flow under the influence of compressibility. How work contributes - will investigate the behavior of a transitional, separating boundary layer in the presence of compressibility effects. This research will contribute to overcoming the noted deficiency.

A procedure will be devised for modeling an ejection seat/man configuration with a finite number of rectangular elements. By means of comparison between computed and experimentally determined values, the various pressure laws available in the Mark IV computer code will be matched with specific flow regions which occur in the configuration of interest.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0009, MIXED FINITE ELEMENT METHODS WITH APPLICATIONS TO FLOW AND OTHER PROBLEMS
M.D. Gunzburger, University of Tennessee, Knoxville Campus, School of Liberal Arts, Dept. of Mathematics, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (DF057400; AFOSR-80-0083)

AF function - design of aerospace and reentry vehicles. Deficiency - these design problems are hampered by the lack of effective and efficient computational techniques to solve the modeling equations. Objective - to investigate stable and accurate numerical techniques incorporating mixed finite element methods to solve modeling problems involving linear systems of partial differential equations. How work contributes - techniques to be developed may lead to more effective and stable numerical algorithms for solving the modeling equations in fluid dynamics.

Recently mixed finite element methods have been developed for the approximate solution of model problems involving linear systems of partial differential equations. In order to insure the stability and optional accuracy of the approximation, these mixed methods required that the finite element trial spaces satisfy certain conditions. One aspect of the proposed research is to characterize and construct grids whose associated finite element spaces satisfy those conditions. A second aspect of the proposed research is to apply these mixed methods to a series of physical problems, namely, the energy stability of the incompressible Navier-Stokes equations and acoustic eigenvalue problems. For each of these, computer programs will be written to test the mixed methods and to illustrate their implementation. Furthermore, analyses will be attempted to obtain theoretical bounds

for the errors of approximation. These bounds will be verified by the computer codes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, LASER SPECTROSCOPY AND COLLISION STUDIES OF MOLECULAR IONS
W.H. Wing, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (12206-AC6)

This proposal concerns continued high-precision spectroscopy of vibration-rotational frequencies of molecular ions, employing a novel ion beam-infrared laser resonance method which has recently produced the first observed infrared spectra of the one- and the two-electron molecules HD ion and HeH ion. These results have opened the possibility of a wide range of molecular ion studies producing highly accurate and detailed measurements both of internal structure and of collision cross-sections of molecular ions in individual vibrational states. Such spectroscopic data are at present nonexistent for most molecular ions except from estimates or theoretical predictions. Similarly, most measured cross-sections are averages over internal-state distributions.

Such spectroscopic observations will establish energy levels of molecular ions to at least the precision with which levels of neutral molecules are now known. Thus the results will be of great importance to quantum chemistry, molecular theory, astrophysics, and the description of high-temperature gaseous and plasma processes.

SUPPORTED BY American Chemical Society

8.0002, ATOMIC PHYSICS
R. Marrus, University of California, Berkeley Campus, Lawrence Berkeley Lab., *Berkeley, California* 94720 (005960 TICNO; 4028)

The MMRD atomic physics group is concerned with the experimental study of collisions and spectroscopy in simple atomic systems. Investigations are being pursued using three different techniques. Using the highly stripped heavy-ion beams produced by the LBL Super-HILAC, charge-changing cross-sections of ions to 8.5 MeV/amu and Z = 92, and electron capture to the continuum are currently under study. Spectroscopic studies of strong uv transitions from low-lying states of heavy ions in the helium-like, lithium-like, and beryllium-like sequences are also in progress. Particular emphasis is placed upon elements important to CTR studies. The Super-HILAC is a unique facility which produces the highest velocity heavy-ion beams available in the US. Ion-trapping techniques are being used to study long-lived states of few-electron ions, with emphasis on forbidden and allowed lifetimes, LASER interactions, and collision processes. Spectroscopy with narrow-band high-power uv LASERs developed by our group is being used to investigate parity nonconservation in atoms to test theories of unified weak and electromagnetic interactions.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0003, MAGNETOSPHERIC PLASMA PHYSICS
C.F. Kennel, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (ATM78-19958)

This research program concerns the dynamics of the magnetic field of the earth and its interaction with particles and fields from the sun. The major aims are: (1) to understand magnetic reconnection, to integrate it into magnetospheric theories, and - something of general significance - to understand the acceleration of energetic particles in reconnection events; (2) to understand the global response of the magnetosphere to time-dependent events in the solar wind; and (3) to understand the role of plasma turbulence in the earth's magnetosphere, with a special emphasis on electrostatic waves.

The effort supported here will be theoretical in nature and will be performed by a team of researchers from the Departments of Physics, Astronomy, Geophysics and Atmospheric Sciences at the University of California, Los Angeles.

The overall aim of the work is to use plasma theory to increase our knowledge of magnetospheric dynamics.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0004, NAVY COMMUNICATIONS - AURORAL CURRENT MODULATION THROUGH RESONANT ABSORPTION IN THE AURORAL IONOSPHERE
G.J. Morales, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DN075276; N00014-80-C-0373)

Theoretical research will be conducted on nonlinear processes associated with resonant heating of auroral plasmas in order to provide the basis for theoretical calculations of low-frequency electromagnetic wave generation for naval communications by modulation of auroral currents or nonlinear or resonant mixing.

Theory will be developed to treat the interactions between intense high-frequency electromagnetic waves at or close to the plasma frequency with auroral plasma. The effects of electron density gradient and of a magnetic field nearly parallel to that gradient will be included. The amplitude of electrostatic waves generated will be determined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0005, AN EXPERIMENTAL STUDY OF SPIN GLASSES AND DYNAMICS OF SUPERCONDUCTORS
R.L. Orbach, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DMR78-27129)

This research is a continuation and extension of work supported under Grant No. DMR-7682347 and constitutes the experimental part of a comprehensive investigation of the dynamics of magnetic spin glasses and fluctuation effects in superconductors. The spin glass study will concentrate on thin films of noble metal elements doped with manganese (Mn) as the magnetic impurity. The ac magnetic susceptibility of these films will be measured as a function of frequency. These films will also be incorporated into proximity effect sandwiches and the current-voltage characteristics of such structures will be determined. Such data allow one to draw definitive conclusions about the nature of the phase transitions in spin glass systems. Tunneling data for sandwiches with different thicknesses of the spin glass film lead to an absolute measurement of the pair-breaking caused by the Mn spins. The spatial and temporal variations of the superconducting order parameter in granular aluminum or aluminum-germanium films doped with erbium as the spin label will be investigated via magnetic resonance and tunneling studies utilizing proximity effect sandwiches. The frequency-dependence of the resistance of superconducting-normal-superconducting sandwiches will be used to study nonequilibrium superconductively with particular emphasis on branch relaxation rates. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0006, PROFILE OF ENERGETIC IONS IN THE ATMOSPHERE
R. Silberberg, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN580199)

To determine the heavy-particle radiation spectrum, especially for highly ionizing nuclei, at different levels within the upper atmosphere, and to apply the data on these penetrating

particles in estimating their potential hazards to high-altitude missions.

A computer code will be developed to transport the heavy-particle radiations through the magnetosphere and into the atmosphere in successive steps, until the particles come to rest or are lost through nuclear interactions. Existing data on energy spectra, composition, geomagnetic effects, energy loss, and nuclear transformations will be utilized. Experiments will be carried out to supplement the limited data that now exist on fragmentation of heavy nuclei in air. The goal of this project, the assessment of heavy-particle radiation effects, involves application of the results to an operational system, such as high-altitude aircraft and its crew.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0007, EQUIPMENT FOR RESEARCH ON FREE-RADICAL MOLECULAR BEAM SCATTERING

J.W. Sheldon, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Physics, *205 Wildwood Dr., Tallahassee, Florida* 32306 (CDP80-18970)

Molecular beams have proved to be excellent tools for studying reactions of energetic molecular species which are rapidly destroyed in single molecular collisions. An HO free-radical molecular beam apparatus is proposed which is a modification of an existing metastable atomic beam facility. The HO source will be an rf gas-discharge reactor utilizing HO. The products of the HO discharge will be collimated, velocity selected and the HO component detected by a quadrupole mass spectrometer. The beam can be attenuated by selected target molecules in a collision cell on the beam path and the results analyzed to yield the long-range potential energy between the free-radical and the target molecule.

This award provides equipment (diffusion pump, mechanical backing pump, etc.) to modify an existing metastable atomic beam facility.

SUPPORTED BY U.S. National Science Foundation, Office of Planning & Resources Management, Div. of Budget & Program Analysis

8.0008, MEASUREMENT OF ION TRANSPORT PROPERTIES, ION REACTION RATES AND TRACE NEUTRAL CONCENTRATIONS OF ATMOSPHERIC INTEREST

E.W. McDaniel, Georgia Inst. of Technology, School of Physics, *225 North Ave. N.W., Atlanta, Georgia* 30332 (ATM80-16881)

This is a two-year program in which major ion constituents of the lower atmosphere will be identified and their transport properties and reaction rates determined using a drift-tube mass spectrometer. This study will commence with the identification and measurement of relative concentrations of ions produced in a drift-tube using directly sampled tropospheric air as the drift gas. Following this study, the mobilities of stratospheric and tropospheric ions in nitrogen will be determined. Upon completion of this work the emphasis of our research on these ions will be shifted to the measurement of absolute equilibrium constants as a function of temperature. Ions will be studied of the form A-(B)n(C)m where n equals 1,2,3 and m equals 0,1,2; A plus or minus is a parent ion such as NO3, SO3, HSO4, NH4 and H (H2O)n and D and C are neutral species such as HNO3, NH3, SO2, NO2, H2O, HCl.

The measurements are needed for atmospheric modeling, to calculate ion-ion recombination rates, to better assess ion collection efficiencies in ion reaction rate measurements, and to provide additional physical parameters by which ions may be identified. Our measurements are also expected to provide an extremely sensitive technique for monitoring trace neutral species in the lower atmosphere.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0009, NUCLEAR STRUCTURE AND REACTION MECHANISMS

A. Scott, University of Georgia, Franklin College of Arts & Sciences, Dept. of Physics, *Athens, Georgia* 30601 (PHY78-07755)

A series of experiments dealing with inelastic proton-nucleus scattering will be carried out at several medium-energy physics laboratories including the Clinton P. Anderson Meson Physics Facility (LAMPF) and the Indiana University Cyclotron Facility. Cross-sections for some simple nuclear transitions will be measured using unpolarized beams and asymmetries in cross-sections will be determined using newly developed polarized beams at these facilities. The experiments performed will help determine the dominant reaction mechanisms in proton-nucleus inelastic scattering and the energy-dependence of these mechanisms with the overall aim of obtaining detailed nuclear structure information. Experiments on inelastic heavy ion-nucleus scattering are also proposed to study the interference between coulomb and nuclear effects in attempts to learn about the matter distributions within nuclei.

This is the continuation of work supported by Foundation Grant PHY76-08788 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0010, ELECTRONIC STRUCTURE AND PROPERTIES OF PERFECT AND DEFECTIVE SOLIDS

A.J. Freeman, Northwestern University, Evanston Campus, School of Arts & Sciences, Dept. of Physics, *633 Clark St., Evanston, Illinois* 60201 (DMR77-23776)

This is a continuation of research previously supported under DMR-7681719.

Several theoretical topics concerning perfect and imperfect solids will be studied. (1) The electronic structure of heavy metals and compounds: For this type of calculation, the discrete variational method will be modified to include relativistic effects. Also, a pseudopotential method for eliminating the core basis function problem will be developed. (2) Defects and impurities: This study will involve the utilization of a small periodic cluster approach. This is equivalent to a superlattice approach, in which the limit of an isolated defect is approached by increasing the unit cell size. (3) Surface states will be examined by the calculation of thin films. A concentrated effort will be made on magnetic materials in order to understand the unusual properties of the surfaces of magnetic solids.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0011, STUDIES OF DISORDERED MATERIALS BY ELECTRON PARAMAGNETIC RESONANCE

H.J. Stapleton, University of Illinois, Urbana Champaign Campus, Materials Research Lab., *Urbana, Illinois* 61801 (004400 TICNO; CH-1198-017)

Fast ionic conductors, amorphous semiconductors, and glasses are typical systems whose special properties depend upon a high degree of disorder. Electron spin relaxation, electron-nuclear double resonance (ENDOR), and electron spin resonance measurements on irradiation-induced paramagnetic centers in disordered materials are yielding data which characterize the additional low-energy states unique to amorphous materials. Our relaxation data from a color center in the conduction plane of K, Li, and Na beta alumina exhibit anomalies in magnitude, temperature-dependence, and microwave frequency-dependence. We have developed a model for electron spin relaxation in glasses and successfully tested it using our data together with the low-temperature heat capacity, thermal conductivity, and dielectric susceptibility data on beta alumina. Experiments still in progress include an ENDOR study of an F-plus center in beta alumina in order to map out the cation distribution in the conduction plane, and spin relaxation measurements on an F-plus center in lithium-doped CaO because it involves relaxation by localized tunneling states having a very narrow energy distribution. Also planned are resonance experiments down to 0.25 degrees K on amorphous silicon, produced by ion implantation, to

determine its relaxation mechanism and the nature of the paramagnetic center common to amorphous silicon.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0012, PHOTOELECTRIC AND PHOTOCHEMICAL STUDIES OF BACTERIORHODOPSIN

H. Frauenfelder, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (INT78-27606 A01)

The objective of this U.S.-Hungarian collaboration is to study the mechanism of light-energy conversion by bacteriorhodopsin (BR). The goal of the research is to obtain a complete set of parameters for the BR photochemical cycle. BR is the purple-colored protein found in the membrane of certain bacteria which live in concentrated salt ponds. BR transfers sunlight energy into electrochemical energy and thereby provides an alternative energy source to respiration. This electrochemical energy enables the bacteria to sustain their metabolic functions.

The Hungarian group at the Biological Research Center of the Hungarian Academy of Sciences will investigate the photoelectric properties of BR in model membrane systems. Photoelectric spectroscopy will be used to measure light/energy transduction and to study the proton-pumping function in BR. The American group at the University of California at San Francisco will produce and characterize the purple membrane samples of BR. The photochemistry of BR in purple membrane suspensions will be studied over wide ranges of time, temperature, pressures, pH values, and salt concentrations at both Urbana and San Francisco. The two American groups will then formulate a general kinetic model to describe, in quantum mechanical terms, the photochemical cycle and photoelectric function of bacteriorhodopsin.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0013, ELECTRONIC STRUCTURE OF SOLIDS AND THEIR SURFACES AND INTERFACES

A.B. Kunz, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DF043360; AFOSR-76-2989)

AF function - Air Force functions such as communications, reconnaissance and surveillance, and command and control depend heavily upon modern electronic systems. Opportunity - improved performance in electronic systems can be achieved once a detailed and complete knowledge of electronic materials is available. Objective - the objective of this research is to determine electronic structure, impurity states and surface properties of materials with potential for improvement of current semiconductor devices. How work contributes -these studies will contribute to the understanding of the electronic properties of device materials and of the effect of impurities and their migration of these materials in such applications as MOS, MIS and heterojunction devices.

Unrestricted Hartree-Fock clusters and pseudopotential calculational techniques will be used to study the electronic structure of III-V binary, ternary, and quaternary semiconductors useful as microwave device materials, the surface of simple metals and their response to simple impurities such as oxygen on Al, the surface structure of simple semiconductors and their response to simple impurities such as oxygen and nitrogen on Si, GaAS and InP, and the surface structure of complex metals and their response to oxygen, hydrogen, nitrogen, and carbon.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0014, ULTRASONIC AND RELATED INVESTIGATIONS OF SOLIDS

R.J. Sladek, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (DMR79-08538)

Ultrasonic and related investigations of acoustic phonon behavior will be carried out for the purpose of relating it to the electrical conductivity and crystal stability characteristics of other phonons or the magnetic properties of crystalline solids exhibiting metal-insulator transitions. Included are electronic conductors and super-ionic conductors. Measurements will be made of the velocity and attenuation of ultrasonic waves as functions of temperature, pressure, and magnetic field at low temperature, and in some cases the thermal expansivity and/or electrical impedance (to determine optical phonon and/or electronic behavior).

It is also proposed to investigate thoroughly a new post-electric-field ultrasonic attenuation enhancement in arsenic triselenide glass, which provides evidence for carrier injection, trapping, and recombination processes and implies that the two-level tunneling systems responsible for ultrasonic attenuation are valence-alternation pairs. The approach will involve heat treatments of samples, characterization of the sample surface, study of infrared quenching of the excess attenuation and detection of recombination radiation and/or changes in conductance due to the high dc field.

This research was previously supported by DMR 7708476. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0015, ELASTIC LIGHT-SCATTERING INVESTIGATION OF THE DEFECT SUBSTRUCTURE OF REFRACTORY OXIDES

W.P. Unruh, University of Kansas, Lawrence Campus, School of Liberal Arts & Sciences, Dept. of Physics & Astronomy, *112 Bailey Hall, Lawrence, Kansas* 66045 (DMR78-10824)

This research will be a coordinated light-scattering investigation of the defect substructure of refractory oxides, with emphasis on magnesium oxide. The aggregation and phase separation of impurities, and their precipitation onto the internal substructure of crystals, will be probed nondestructively in high-quality samples by means of three complementary elastic light-scattering methods. The goal is to obtain fundamental information regarding the mobility, diffusion, nucleation and spatial distribution of phase-separated and aggregated impurities and defects in this important class of materials. Progressive changes in defect substructure will be followed as standard thermal sequences are applied to the materials. Because even trace impurities are inhomogeneously distributed, this substructure plays a dominant role in the transport, optical and mechanical properties of high-quality transparent dielectric materials. This research will contribute to the fundamental understanding of the mechanisms which produce the highly inhomogeneous defect substructure in high-quality refractories containing nominal impurity concentrations. It is expected that this knowledge will suggest ways in which inhomogeneities may be reduced or eliminated, a result which would significantly improve the technical applicability of these durable materials.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0016, COSMIC RAY SPECTRA AND INVESTIGATION OF THE TIME STRUCTURE OF THE HADRONIC COMPONENTS OF AIR SHOWERS

R.W. Ellsworth, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics, *College Park, Maryland* 20742 (PHY79-09272)

This project consists of two parts. The first is a direct measurement of the energy spectrum of primary cosmic ray protons in the energy range 100 to 50,000 CeV. This uses a balloon-carried spectrometer, an ionization calorimeter, to measure energies. In the other experiment, which is ground-based at sea level, we study the cascade of particles produced by high-energy cosmic ray particles striking the atmosphere - an extensive air shower. This group will measure the energies and relative arrival times of protons and other nuclear particles with respect to the very fast particles of the cascade. We have learned from previous experiments that this time structure is sensitive to the presence of heavy nuclei (e.g., iron) in the primary composi-

tion, at extremely high energies. This experiment will find the relative magnitude of the primary iron component at energies up to 50-million GeV. These data will provide crucial tests of theories of the origin and propagation of cosmic rays.

In addition, our sea level experiment is sensitive to the production of new massive elementary particles, since these will be delayed and also carry considerable energy. Some evidence for such production has already been found in smaller scale experiments. Confirmation of the existence of new massive states would be an important development in the understudy of fundamental components of matter.

This is the first year of a three-year continuing grant, previously supported under NSF grant PHY77-01438 A02.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0017, STATISTICAL MECHANICS OF MATERIALS NEAR PHASE TRANSITIONS

H.E. Stanley, Boston University, School of Liberal Arts, Dept. of Physics, *755 Commonwealth Ave., Charles River Campus, Boston, Massachusetts* 02215 (DMR76-82481)

Theoretical research will be carried out concerned with the applications of statistical mechanics of materials near a phase transition. A particular emphasis will be on the problems associated with random materials. Percolation phenomena will be studied by means of a recently developed large-cell position space renormalization group approach, which permits the evaluation of critical parameters with an accuracy comparable to that of series expansion methods. A principal goal of the work will be to adapt renormalization group methods to study the behavior of a random dilute magnet. Another problem which will be studied is the connectivity property of a lattice gas model. This is a new area of study known as the 'correlated' percolation problem, which should lead to an increased understanding of the properties of random systems.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0018, EXPERIMENTAL INVESTIGATIONS OF CRITICAL PHENOMENA

P. Heller, Brandeis University, School of Arts & Sciences, Dept. of Physics, *415 South St., Waltham, Massachusetts* 02154 (DMR78-03026)

An experimental research program will be carried out to study critical phenomena in antiferromagnets and structural phase transitions in solids. These studies will include: (a) nuclear magnetic resonance (NMR) experiments with antiferromagnetic manganese fluoride and ferrous fluoride and neutron-scattering experiments on antiferromagnetic CuCl2-2D2O in large external magnetic fields, (b) computer simulation studies of dynamical behavior in model spin systems to be compared to related NMR experiments, and (c) light-scattering studies of structural phase transitions in strontium titante under stress in analogy to the magnetic phase transition of the antiferromagnetic in an applied field. These experiments will contribute to our understanding of the static and dynamic behavior of a system near its phase transition.

This is a continuation of research previously supported under DMR75-03610. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0019, HIGH-ALTITUDE CHARGE TRANSPORT

M. Kanal, Clark University, Graduate School, Dept. of Physics, *950 Main St., Worcester, Massachusetts* 01610 (DF582520; F19628-79-C-0008)

AF function - satellite communication, navigation, command and control. Deficiency - inadequate knowledge of high-altitude transport and heating mechanisms for the proper interpretation of data from AF satellites. Objective - to calculate the effects of high-altitude electron-ambient plasma coulomb interactions and the pitch-angle scattering of electrons in the plasmasphere on electron transport in the upper atmosphere. Results will be compared with current AF satellite data. How research contributes - provides information essential to microwave and radio frequency transmission through the upper ionosphere. Provides data essential for design and utilization of communication guidance and surveillance systems. Provides understanding of upper ionosphere transport mechanisms which affect the neutral upper atmosphere.

Solve the Boltzmann equation for high-altitude (above 500 km) conditions, emphasizing the plasmasphere and taking into account the effects of coulomb interactions and pitch-angle scattering. From this solution calculate the heat flow vector and compare the predicted electron temperatures with those obtained from AF satellites.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

8.0020, THEORY OF INTERACTIONS OF MESONS AND NUCLEONS WITH NUCLEI

M.M. Sternheim, University of Massachusetts, Amherst Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Amherst, Massachusetts* 01002 (PHY77-07592 A02)

Research initiated under NSF grant PHY77-07592A01 on theoretical problems in the field of intermediate energy nuclear physics will continue.

Processes in which only incomplete information is obtained about the outgoing particles in an intermediate energy reaction are considered to be incoherent. The interference effects in a quantum mechanical calculation tend to cancel, so that semiclassical models are valid. The validity of various semiclassical approaches will be studied, and cross-sections for several processes of interest will be calculated.

Pion-nucleus scattering is described theoretically with the aid of an optical potential. Under the present NSF grant, it has been shown recently that purely phenomenological approaches to finding this potential have serious ambiguities. The present program will study the comparison of theory and experiment in this area, with the goal of extracting nuclear information.

Finally, nuclear processes will be used to set limits on the masses of various particles hypothesized by particle theorists.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0021, FAR INFRARED AND THERMAL STUDIES ON LOW-TEMPERATURE MATERIALS

C.C. Huang, University of Minnesota, Minneapolis Campus, School of Physics, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (004776 TICNO; 0641-5521)

In the proposed investigations, the optical absorption coefficients of some low-temperature materials, such as V3Si, V3Ge, Nb3Ge, Nb3Sn, rare-earth rhodium borides, Chevrel phase compounds, and superionic conductors, will be measured by the modulated far infrared spectroscopy, a technique which will provide Eliasberg function alpha2F(omega) directly of a superconductor. Furthermore, measurement of heat capacity and electrical and thermal transport coefficients of V3Si will be carried out in the vicinity of the structural and superconducting phase transitions. The fabrication of a modulated far infrared spectrometer system will be completed in the near future. In the thermal studies, a transforming V3Si crystalline sample has been demonstrated to be a weak coupling superconductor. A systematic investigation of the effect of Si contents on the structural phase transformation in a V3Si sample has been carried out.

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SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research, Office of Basic Energy Sciences

8.0022, SURVEILLANCE DISSOCIATIVE CHARGE TRANSFER EXCITATION
J.J. Leventhal, University of Missouri, St. Louis Campus, School of Arts & Sciences, Dept. of Physics, *8001 Natural Bridge Rd., St. Louis, Missouri* 63121 (DN675483; N00014-76-C-0760)

Charge transfer processes occur in many gaseous lasers, in the ionosphere, and plasmas. Radiative charge transfer is an important means of producing population inversion in metal vapors. Thus, it is important to the naval areas of communications and surveillance to obtain a better understanding of the mechanisms involved in charge transfer excitation of metal vapors which have potential laser application.

The soft X-ray-Xuv spectrometer is being calibrated. The final state products and respective cross-sections are being determined for collisions of Li with He (plus)-(plus).

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0023, MERCURY-CADMIUM-TELLURIDE SPUTTERING RESEARCH 14907-P
R.H. Cornely, New Jersey Inst. of Technology, School of Engineering, Dept. of Electrical Engineering, *323 High St., Newark, New Jersey* 07102 (DA0F9178; DAAG29-79-C-0056)

To study the properties of single crystal films of mercury-cadmium-telluride as functions of a wide range of sputtering deposition parameters. Relevance - there is a long-standing need for the fabrication of large element arrays of photovoltaic and photoconductive devices for wide-angle infrared sensing in the 3-15, 8-14, and 18-25 micrometers wavelength regions.

Single crystal films of mercury-cadmium-telluride will be deposited and grown utilizing r.f. triode-sputtering techniques in a mercury-vapor atmosphere. The properties of the films to be investigated include band-gap carrier concentration, mobility, chemical composition and film stoichiometry, all very sensitive to deposition parameters as well as mercury-sputtering gas pressure.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0024, APPLICATIONS OF MANY-BODY THEORY
P.W. Anderson, Princeton University, School of Natural Sciences, Dept. of Physics, *Box 430, Princeton, New Jersey* 08540 (DMR78-03015)

Theoretical studies of condensed matter systems previously supported by NSF grant DMR-7600886 A01 will be continued and extended. Many-body theoretical concepts and techniques will be used to further develop the theory for amorphous and random materials with attention given to the problems of minimum metallic conductivity and of 'tunneling centers' in glasses. Work on the 'Anderson' model has evolved into a general attack on the problem of mixed-valence metals and of ultra-strong-coupling superconductors. This work will continue. Also, studies of problems in condensed matter physics related to neutron stars and to a topological theory for defects will continue.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0025, PHYSICS OF SUBMICRON SYSTEMS
J.A. Krumhansl, Cornell University, Ithaca Campus, Lab. of Atomic & Solid State Physics, *Clark Hall, Ithaca, New York* 14850 (DN075450; N00014-80-C-0489)

Electron devices for advanced Navy electronic systems are evolving towards smaller and smaller dimensions. There is a need to understand the electronic properties of submicron-scale structures and the mechanisms for current transport on such scales.

To investigate theoretically the electronic and vibrational properties of atomic systems of submicron dimensions. Calculations will be made of the distribution of energy states, spatial correlations, and wave packet propagation. Subsequently, point defects and surface perturbations will be included. Computer modeling will address questions about the electron-phonon interaction and its effect on transport. A separate effort will address the quantum transport problem for non-instantaneous collisions pertinent to high-electric-field phenomena.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0026, NEW SEMICONDUCTOR MATERIALS FOR MICROWAVE DEVICES 14354-EL
J. Frey, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (DA0F9118; DAAG29-80-C-0071)

To identify ternary and quaternary III-V compound semiconductors which may be more suitable than GaAs for high-performance microwave devices, such as field-effect transistors (FETs) and transferred-electron devices (TEDs). Relevance - microwave devices fabricated from III-V ternary and quaternary materials offer the possibility of extending the frequency-of-operation, increasing the available power and gain, and decreasing the noise over existing GaAs devices. Such devices would impact Army communications/navigation systems in tactical, satellite, and missile guidance applications.

The Monte Carlo method will be used to study the steady-state and transient high-field transport properties of III-V ternary and quaternary semiconductors. Material parameters will be obtained from an interpolation procedure which uses known material parameters for the binary compounds of which the ternary and quaternary materials are composed. This technique will generate fundamental transport parameters which will then be used in device models to predict figures-of-merit for FETs and TEDs. The fundamental gain, power, frequency response, and noise-determining mechanisms will be studied.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0027, DISPERSION FORCES OF SOLIDS UNDER STRESS 15385-P
L.C. Biedenharn, Duke University, Trinity College of Arts & Sciences, Dept. of Physics, *Durham, North Carolina* 27706 (DA0F9043; DAAG29 79 D1001)

To arrive at a realistic potential energy function for adatom-solid surface adsorption that will be valid when the solid is under high external stresses. Relevance - the calculations are directly relevant to stress-corrosion and wear problems of the Army.

To use diagrammatic field-theoretic techniques to obtain the dielectric response function as well as to use a phenomenological approach to include changes in the polarizabilities of the solid when the solid is stressed.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0028, USE OF LASER SPECTROSCOPY TECHNIQUES FOR INVESTIGATING ENERGY TRANSFER AMONG IONS IN CRYSTALS
R.C. Powell, Oklahoma State University, School of Arts & Sciences, Dept. of Physics, *Agricultural Hall, Stillwater, Oklahoma* 74075 (DMR79-16152)

The characteristics of energy transfer among ions in crystals will be investigated by means of laser spectroscopy techniques. The primary systems to be studied are the rare-earth pentaphosphates. Time-resolved site-selection spectroscopy and fluorescence line-narrowing techniques will be used to investigate the interaction between ions in slightly different types of crystal field sites. The transient grating method will be used to determine exciton diffusion lengths. Coherent transient measurements will be used to determine relaxation time and detect any coherent motion contribution to the migration. By studying mixed crystal systems the effects of disorder on energy transfer in these materials will be determined.

This is the first year of a new three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0029, AN INVESTIGATION OF THE PRODUCTION, RELAXATION AND DISSOCIATIVE RECOMBINATION OF VIBRATIONALLY EXCITED IONS OF AERONOMIC IMPORTANCE

E.C. Zipf, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (ATM79-06920)

The compositional and thermal structure of the upper atmosphere depends importantly on the chemistry of its constituent species formed in energy states other than the ground-level state. We have much yet to learn about such chemistry.

This grant funds a program of research on the dissociative recombination of molecular ions of aeronomic importance. In this continuing effort experiments will be carried out that exploit newly developed laser-induced photofluorescence techniques: (1) To measure the dissociative recombination coefficients for specifically identified rotational and vibrational levels. (2) To determine the identity and absolute production rates of the important metastable species (e.g., N(2P), N(2D), O(1S), and O(1D)) formed by this process as a function of the rotational and vibrational temperature of the ions and the electron temperature of the plasma. (3) To study the vibrational and rotational relaxation of hot plasma ions. (4) To investigate the ion-molecule reactions of vibrationally excited ions.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0030, ADVANCED NUCLEAR SYSTEMS - ISOTOPE FUELS

R.A. Brownback, E.I. du Pont de Nemours & Co. Inc., *P.O. Box A, Aiken, South Carolina* 29801 (006311 TICNO; ANS)

This activity includes the production of iridium-clad pure plutonium-238 heat sources for space and special applications. In FY 1980, the production of multi-hundred-watt (MHW) spherical heat sources (approximately 103.5 watts each) will end in February and the PuFF facility equipment will be modified to permit the production of general purpose heat sources (approximately 62.5 watts each) which is due to start in April after the new equipment is installed and tested. The production rate is expected to be 16 units per month for a total of 372 units produced by May, 1982. PuFF will continue thereafter to produce fuel forms through FY 1986 to meet DOE requirements. Disassembly of encapsulated heat sources and radioisotopic thermoelectric generators will continue throughout the budget period as they become available from other DOE sites.

SUPPORTED BY U.S. Dept. of Energy, Office of Policy & Evaluation, Office of Nuclear Energy

8.0031, EXPERIMENTAL ATOMIC, MOLECULAR, AND NUCLEAR PHYSICS

C.F. Barnett, U.S. Dept. of Energy, Oak Ridge National Lab., *P.O. Box X, Oak Ridge Operations Office, Oak Ridge, Tennessee* 37830 (003813 TICNO; W-7405-ENG-26)

Atomic collision processes, particularly for atomic impurity ions, critically influence the dynamics of heating, cooling, and particle transport of high-temperature plasmas such as those produced in tokamaks. Atomic collisions directly influence plasma diagnostics as well. Pertinent cross-sections and collisional rates are being determined both experimentally and theoretically. Experimentally, crossed beams of multicharged ions and electrons are providing excitation and ionization cross-sections relevant to ionization balance, radiation power loss, and spectral line formation in high-temperature plasmas. Cross-sections for electron capture and ionization collisions of multicharged impurities with atomic hydrogen are being measured with crossed beams with thermal H degrees targets at plasma velocities and at neutral-beam injection velocities. These capture cross-sections influence beam-energy deposition, diagnostics, and ionization equilibria. Theoretical descriptions characterize the general trends of these cross-sections with ionic charge and collision velocity. Recent theory has also addressed the question of ion-electron recombination in the presence of electric and magnetic fields encountered in tokamaks.

BIBLIOGRAPHIC REFERENCES: Meyer, F.W., et al., Single-Electron-Capture Cross-Sections for Multiply Charged O, Fe, Mo, Ta, W, and Au Ions Incident on H and H2 at Intermediate Velocities, Phys. Rev. A 19: 515 (1979).

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research, Office of Fusion Energy

8.0032, IMPURITY STUDY PROGRAM

R.A. Langley, U.S. Dept. of Energy, Oak Ridge National Lab., *P.O. Box X, Oak Ridge Operations Office, Oak Ridge, Tennessee* 37830 (003845 TICNO; 00027(19))

The purpose of the Impurity Study Program is to identify the controlling impurity generation mechanisms and to minimize their effects. The approach of the ORNL program is a vigorous interactive coalition of surface scientists and plasma physicists which focuses on in situ tokamak and EBT experiments. It has coordinated efforts in four main task areas which are: (1) in situ measurements; (2) development of new diagnostics; (3) plasma materials simulation experiments; and (4) controlled laboratory investigations. The program involves the study of hydrogen recycle, the study of impurity introduction mechanisms, the in situ testing of special materials such as limiters, beam dumps, armor plate, and divertor plates, the measurement of impurity charge state in the plasma scrape-off region and the study of clean-up techniques. Studies of neutral beam injector impurities and hydrogen species energy distributions are being made as functions of injector parameters.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research, Office of Fusion Energy

8.0033, HEAVY ION-INDUCED IONIZATION STUDIES RELATED TO CHEMICAL BONDING AND ELECTRON SCREENING

J.L. Duggan, North Texas State University, School of Arts & Sciences, Dept. of Physics, *N. Texas Station, Box 13707, Denton, Texas* 76203 (B-629)

Ionizations in the K, L and M shell have been studied by observing the characteristic and noncharacteristic X radiations from solid and gas targets when bombarded with heavy ions (1 is less than Z2, which is less than 25). These fast-moving projectiles are produced with a Van de Graaff accelerator in an energy range between 1 and 50 MeV. The target range studied thus far extends from Z1 equals 12 to Z1 equals 83. The cross-sections for these ionization processes are studied as functions of energy, incident charge state, and target thickness. The measured ionization cross-sections are compared to the Binary Encounter Approximation (BEA) and the Plane Wave Born Approximation (PWBA). In its most complete form the PWBA has been modified to include corrections for increased binding energy, coulomb deflection of the incident ion, orbital perturbation due to polarization, relativistic effects, and electron capture. The charge state data for 21Sc, 22Ti, 29Cu and 32Ge by 52 MeV 28 14Si plus 8 projectiles with q equals 7-to-14 demonstrate the validity of a recently developed electron capture theory with reduced binding. The data also show evidence for the applicability of perturbed stationary-state theory of direct ionization for these studies.

SUPPORTED BY Robert A. Welch Foundation

8.0034, DIFFUSION OF WATER BY NEUTRON SCATTERING

H.E. Rorschach, Rice University, Wiess School of Natural Sciences, Dept. of Physics, *6100 Main, Houston, Texas* 77001 (DN975434; N00014-79-C-0492)

Water makes up 70-90% of the mass of living cells. Quasi-elastic neutron scattering is the most accurate method for measuring the diffusion motion of water molecules. The diffusion of water molecules controls the entry and release of food and energy in cells. An understanding of the true diffusion coefficient of water in living cells will allow a better understanding of the movements of water, electrolytes, and metabolites in shock and disease among Navy personnel.

The self-diffusion coefficient of water molecules in pure solution, in polymer solutions, in biological model systems such as collagen and in brine shrimp, will be measured by the highly accurate techniques of quasi-elastic neutron scattering in collaboration with the Solid-state Physics Division at Oak Ridge Na-

tional Laboratory, Oak Ridge, Tennessee. Pilot experiments have shown that the equipment at Oak Ridge has sufficient resolution to attempt these experiments.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0035, HIGH-PRESSURE PHASES OF COPPER CHLORIDE AND HIGH TRANSITION TEMPERATURE SUPERCONDUCTORS

C. Chu, University of Houston, School of Pharmacy, Dept. of Physics, *3801 Cullen Blvd., Houston, Texas* 77004 (DMR79-08486)

This research is a continuation and extension of work supported under NSF grant No. DMR-7723204. A broadly based experimental program involving the use of ultra-high pressures and low temperatures will investigate the electrical, magnetic, thermal, optical and superconducting properties of a variety of alloys and compounds. Initial efforts will concentrate on a detailed study of the high-pressure-phase of copper chloride. Concomitant with this work will be a study of the effect of ultra-high pressures on the magnetic properties of metallic elements and compounds as well as on the ternary molybdenum chalcogenides.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0036, POSITRON AND POSITRONIUM CHEMISTRY IN MOLECULAR GASES

J.D. McNutt, University of Texas, Arlington Campus, School of Science, Dept. of Physics, *Arlington, Texas* 76019 (Y-400)

The formation and properties of positron and positronium compounds, their chemical reactions, and positronium formation processes are being investigated by measuring lifetime spectra for positrons annihilating in gaseous N2 and N2-Ne mixtures at 77 degrees K, and in gaseous C2H6 and C2H6-Ne mixtures in the range 256 to 383 degrees K. The first-ever observation of a temperature-dependence for the positronium yield has been made for N2 gas, whereas the yield for C2H6 is temperature-independent but at 80 percent is the highest yet observed for any substance. The formation at relatively low gas densities of e-positron C2H6 compounds and of e-positron (C2H6)n cluster states at higher densities has been observed, and the formation and properties of these compounds are being extensively studied. The first-ever observation of a temperature-dependence of the orthopositronium annihilation rate has been made for C2H6 at low densities. The annihilation rate of orthopositronium formed in C3H6 at higher densities has been found to be markedly sensitive to density fluctuations in the gas. The latter effect is also being extensively investigated, particularly in the critical region, and is believed to be a potentially valuable probe of microscopic density fluctuations. The experiment results are being utilized for theoretical calculations and model verifications.

SUPPORTED BY Robert A. Welch Foundation

8.0037, ROCKET-BORNE ELECTRON SOURCE

W.R. Pendelton, Utah Higher Education System, Utah State University, School of Science, Dept. of Physics, *Main Bldg., Office 104, Logan, Utah* 84321 (DF580550; F19628-78-C-0103)

AF function - detection. Deficiency - lack of knowledge of atmospheric processes controlling infrared and optical backgrounds. Objective - a rocket-borne electron source will be designed, fabricated and tested for eventual integration in a rocket payload designed to determine specific atmospheric parameters by means of electron-induced optical emissions. A rocket-borne echelle spectrometer will measure relative band intensities, band profiles and absolute band intensities of specific molecular emission excited by a rocket-borne electron source. The emissions will be interpreted in terms of CO2, O2 and O and N2 atmospheric densities as well as N2 rotational and vibrational temperatures. How research contributes - the rocket payload measures a series of atmospheric parameters that control infrared 4.3-micrometers CO2 emission in both auroral and nuclear disturbed atmospheres. The results provide insight into the spectral, spatial and temporal nature of ir backgrounds under auroral and nuclear disturbed conditions.

A rocket-borne electron source will be designed and fabricated to provide a beam of electron-induced optical emissions to be observed by a rocket-borne echelle spectrometer. The spectrometer measures the molecular band profile and photon emission rate of selected molecular emissions induced by an energetic beam of electrons. The electron source energy and current and the spectrometer are designed as a compatible system with the measurement precision of the ambient atmospheric parameters of the principal design criteria.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

8.0038, SURVEILLANCE - SUPERCONDUCTIVE ELECTRONICS

B. Deaver, University of Virginia, School of Arts & Sciences, Dept. of Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (DN775534; N00014-77-C-0440)

The objective is to study the properties of superconducting microbridge devices using the Josephson effects for millimeter wave-mixing and for new types of infrared detectors and optically controlled fast-digital devices of interest to the Navy for surveillance.

A millimeter wave-mixer operating above 100 GHz is being built using superconducting niobium variable-thickness microbridges. Its properties are being characterized by measurements of the dc I-V curves for various values of temperature, magnetic field and incident microwave power. Device interactions with semiconductor substrates are being studied as functions of type of semiconductor, type of impurity dopant, temperature, magnetic field and intensity and wavelength of light irradiating the junction region.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0039, TRICRITICAL PHENOMENA AND STATISTICAL MECHANICS

E.K. Riedel, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98195 (DMR77-12676)

Research begun under NSF Grant No. DMR 76-01070 will be continued and extended. Theoretical studies on the statistical mechanics of phase transitions and critical phenomena will be undertaken. Two types of problems will be studied in this general area: 1) scaling field approach to critical phenomena, and 2) model calculations. The scaling field research will be concerned with the completion of work on the basic formalism, the development and perfection of the calculational techniques, and tests through applications to specific systems. Model calculations will be performed for 1) phase transitions in quasi-two-dimensional systems, 2) percolation and critical phase transitions in systems with random defects, and 3) the structure of the interface between ordered phases.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0040, CHARACTERIZATION OF SUPERCONDUCTORS BY ULTRASONIC SURFACE WAVE TECHNIQUES

M. Levy, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Physics, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DF041820; AFOSR-76-2893)

AF function - high-temperature superconducting materials are needed for application in airborne multimegawatt power generation and conditioning systems. Opportunity - research specifically directed toward the synthesis and characterization of high-transition-temperature metallic compounds can provide a greater margin of design efficiency and operational reliability than presently available superconductors. Objective - the aim of this research is to characterize superconductors by means of ultrasonic surface waves and to relate physical properties with critical superconducting parameters. How work contributes - for many potential applications the performance of high-field

magnets and solenoids, electric motor windings, superconducting rotors in power generators, transformers and induction energy storage systems could be significantly improved if the upper critical field, the current-carrying capacity and the critical transition temperature of the superconducting material could be enhanced.

Films of the beta-tungsten compounds and alloys will be investigated with surface acoustic waves. Measurements as functions of temperature should yield information about possible structural phase transitions that may occur above the superconducting transition temperature. Measurements in the superconducting state as functions of temperature should characterize the distribution of the density of superconducting material in the film as a function of temperature. In addition, the electron mean-free-path in the film will be determined. Measurements as functions of magnetic field in the superconducting state will measure flux-pinning and flux flow in the films. Attempts will be made to measure the electron interaction parameter in pure Al films in order to determine if the high TC of superconducting films may be attributed to the presence of surface phonons. Time-of-flight and ultrasonic attenuation measurements of both longitudinal and transverse waves will be performed on the bulk samples as functions of temperature and magnetic field. Thermal expansion measurements will also be performed in order to determine the elastic constants of these samples. A magnetometer will be used to determine the Ginzburg-Landau parameters for the type II superconductors. The ultrasonic attenuation coefficient will be measured in the superconducting and mixed states of bulk beta-tungsten alloys, alloys made of titanium, molybdenum, aluminum, etc. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0041, THEORETICAL STUDIES OF THE MAGNETIC PROPERTIES OF SOLIDS

D.L. Huber, University of Wisconsin, Madison Campus, School of Natural Sciences, Dept. of Physics, *Agriculture Hall, Madison, Wisconsin* 53706 (DMR79-04154)

Research previously supported by DMR7701057.

Theoretical research on the magnetic properties of solids will be carried out. The main emphasis will be on solids containing rare-earth and transition metal ions. The specific projects to be pursued will include: 1) the calculation of the properties of rare-earth magnets which focus on the dynamical behavior near a second-order phase transition, 2) an investigation of the dynamics of quasi-one- and two-dimensional planar magnets, with a particular emphasis on effects which can be probed using ultrasonic, nuclear and paramagnetic resonant techniques, 3) the study of the properties of disordered magnets showing spin glass behavior, and 4) the investigation of energy transport among magnetic ions in paramagnetic crystals.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0042, DIAGNOSTICS OF ICRF-HEATED PLASMA

H. Kang, Korean Atomic Energy Research Inst., *Cheong Ryangri, P.O. Box 7, Seoul, Republic of Korea* (2670/RB)

The experimental apparatus consists of a coil from a tunable RF generator, a single-turn coil connected to a Marx generator via Blumlein, and two steady magnetic field coils, all winding a plasma tube of ID 10 cm, length 300 cm. By either tuning the frequency of the RF generator, or adjusting the currents of two steady magnetic field coils, the condition of Wci equals Wo can be made.

At high frequency of the RF generator (approximately 10 MHz), the ion cyclotron resonance will be observed during the duration of the additional pulse magnetic field in the presence of the steady magnetic field. Hence, if the significant electron (ion) temperature increase is observed at the center of the single-turn coil during the duration of the pulse magnetic field (approximately 1 usec.) in the presence of the steady field, compared to the temperature increase at the same position during the pulse magnetic field in the absence of the steady magnetic field, the growth time of instability by which the electrons (ions) are heated must be less than approximately 1 usec. Part of the objective of this project is to investigate whether such instabilities exist or not.

The ion temperature is measured by Doppler broadening of He I (5015 A) and He II (4686 A) lines. Also, the measurement of the electron and ion temperature will be performed by the CO laser-Thomson scattering.

SUPPORTED BY International Atomic Energy Agency

8.0043, THEORETICAL STUDY OF CHARGE EXCHANGE, IONIZATION AND ELECTRON LOSS PROCESSES, RELEVENT TO CONTROLLED THERMONUCLEAR RESEARCH

R.K. Janev, Institut za Fiziku, Dept. of Theoretical Physics, *Studentski trg 12/V, P.O.B. 57, Belgrade, Yugoslavia* (2043/R1/RB)

The processes of charge exchange, ionization and electron loss of colliding partners and at collision energies of interest to fusion research will be studied theoretically. The main objective of this investigation is to obtain more information on the mechanisms of the above processes when one of the colliding particles is a multicharged ion. A second objective is to get quantitative data (as accurate as possible) on their collisional characteristics (total cross-sections, transition probabilities, etc.). The methods that will be applied in the investigations are either based on the asymptotical atomic collision theory (for the low- and medium-energy regions) or belong to the class of second-order methods (CDW, etc.).

SUPPORTED BY International Atomic Energy Agency

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, A LABORATORY STUDY OF MAGNETOSPHERIC PROCESSES

R.S. White, University of California, Riverside Campus, Inst. of Geophysics & Planetary Physics, *Riverside, California* 92502 (ATM78-19231)

The Institute of Geophysics and Planetary Physics at the University of California, Riverside, operates a unique facility for the study of magnetohydrodynamic processes related to solar flares and magnetospheric substorms. The research provides an experimental foundation for a theory of basic magnetic processes of interest to solar and space physics.

Previous research on several neutral-point devices has led to new ideas about solar flare mechanisms while verifying some older ones. With the support provided here, work will be completed. The results are expected to aid interpretation of observations and solar flare prediction efforts.

A new effort will be started on a second-generation terrella device simulating the terrestrial magnetosphere. Fundamental problems in magnetospheric structure and dynamics will be investigated - merging entry layer, mantle, convection, energy storage, substorms, and acceleration mechanisms.

The basic techniques are those of plasma physics and require ultra-fast photography, magnetic field and flux measurements, and particle density, current density, and electric field measurements. In addition, energetic X-rays and particles will be detected. These techniques have all been developed for previous measurements at the University of California, Riverside.

The major aim is to use laboratory techniques to investigate space plasma behavior.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

10.0002, A SEARCH FOR ERUPTIVE MASS TRANSFER IN ALGOL-LIKE ECLIPSING BINARY SYSTEMS

E.C. Olson, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Astronomy, *Urbana, Illinois* 61801 (AST78-14469)

Studies of 'Algol-like' eclipsing binary star systems have produced a better understanding of close binaries. The key to

Algol system evolution is mass transfer from the evolved star, which has filled its Roche lobe, to the other less-evolved star. Much evidence suggests that the details of the transfer mechanism must be understood better before a clearer model of Algol evolution can be achieved. The fluctuating mass-transfer event observed in the binary U Cephei may be symptomatic of Algols in general. Such events offer new means of estimating mass-transfer rates, of studying the dynamics of the process, the instability of the mass-losing star, and the response of the mass-receiving star. For the first time, in U Cephei there is an observed association between an eruptive transfer event and a sudden orbital period decrease. An intensive photometric search for such activity will be undertaken. It will accumulate a large body of standardized four-color and near-infrared photometry of six to a dozen systems that can also be used for future photometric solutions. It will further provide the basis for studying times of primary eclipses as a function of wavelength. Analysis of prior data on U Cephei will be continued.

Prior support was by NSF grant AST 76-24639.

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Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0003, F CORONA RADIAL VELOCITY MEASUREMENTS AT THE FEBRUARY 16, 1980 TOTAL SOLAR ECLIPSE

W.I. Beavers, Iowa State University of Science & Technology, College of Sciences & Humanities, Dept. of Physics, *Beardshear Hall, Ames, Iowa* 50010 (AST79-21980 A01)

At an eclipse site in India observations will be made during the February 16, 1980, total solar eclipse to obtain the line-of-sight velocity of the dust in the outer solar atmosphere. Such observations are possible from the ground only during eclipses. Limited data were obtained during the February, 1979, solar eclipse with a preliminary version of the equipment. Observations at two positions (3.2 and 4.3 solar radii from the Sun) revealed the presence of several dust components in each line of sight, with velocities covering the range minus-300 to plus-300 kilometers per second. With the feasibility of such observations demonstrated, the equipment will be improved to obtain higher velocity resolution and better signal-to-noise ratio. Two radial velocity spectrometers will be employed at the NSF-sponsored site in India, where there is high probability of favorable weather. The purpose is to obtain velocity observations at many positions near the Sun to obtain a picture of the nature and dynamics of the dust filling the inner part of the region between the Earth and the Sun.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0004, AIRGLOW AND AURORAL STUDIES OF THE EARTH'S IONOSPHERE

M.A. Biondi, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (ATM78-27598)

This grant funds a program of twilight and night airglow observations using passive optical techniques - chiefly Fabry-Perot (FP) interferometers, tilting filter photometers and multichannel mapping photometers. At Laurel Ridge Airglow Observatory, Pennsylvania (LRAO), continuing measurements of mid-latitude thermospheric wind vectors and temperatures will provide information on scale sizes of upper atmospheric ciruclation cells and flow patterns. The data will also be correlated with simultaneous measurements by another researcher (G. Hernandez) at Fritz Peak Observatory (Colorado) during geomagnetic quiet and storm periods. The LRAO neutral wind data will also be used to test the models by which Millstone Hill incoherent scatter measurements of ionospheric parameters are used to infer neutral motions. A new infrared FP observing He I 1.083 microns in twilight will be used to study the helium escape and high-altitude wind vectors and temperatures. At Arecibo Observatory, Puerto Rico, participation will continue in the IME (ionospheric modification experiments), correlating IME-produced changes in 630.0 nm and 557.7 nm atomic oxygen emission intensity with backscatter radar and ionosonde data to infer changes in the airglow atomic collision processes and to test the theories of electron acceleration by RF-induced plasma instabilities.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0005, A PANORAMIC DETECTOR FOR HIGH-DISPERSION ASTRONOMICAL SPECTROPHOTOMETRY

D.L. Lambert, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST78-18265)

A new spectroscopic detector will be designed, fabricated and installed on the 2.7-meter telescope at the McDonald Observatory. The detector will employ eight diode arrays arranged end-to-end along the focal plane of the spectrograph camera in the Coude spectrograph. The new detector will provide about 14,000 simultaneous data elements. It will exploit the high quantum efficiency, wide spectral band-pass, geometric stability, good dynamic range, linearity and photometric precision of the modern diode arrays. The new detector will have substantially improved signal-to-noise characteristics, greater spectral resolution and improved photometric stability over the present system.

The new detector will be used in observational programs including: determination of the abundances of carbon, nitrogen, oxygen and other heavy metals in type F and G main sequence stars; measurement of magnetic fields in selected stars; analysis of densities and flows of ionized gas in close and rapidly evolving binary star systems; and measurement of accurate radial velocity variations in dwarf Cepheid and related stars.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0006, IMPROVED INFRARED ARRAY SPECTROMETER SYSTEMS AT THE UNIVERSITY OF WYOMING

R.D. Gehrz, University of Wyoming, School of Arts & Sciences, Dept. of Physics & Astronomy, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (AST79-05131)

A new program to develop improved array detectors for infrared astronomy will be started at the University of Wyoming. Construction of new and efficient spectrometers of advanced design will be completed. They will be provided with arrays of state-of-the-art photoconductive detectors. The new detectors will enable the full potentialities of the new spectrometer systems to be fully realized.

The array spectrometer systems will be used in observational programs now being conducted with the 92-inch telescope of the Wyoming Infrared Observatory. The scientific thrust of these programs is to improve our understanding of the formation and death of stars. Observations of regions of high stellar formation activity such as the Orion Nebula will be continued as will studies of such highly evolved stellar systems as classical novae, Wolf Rayet stars and old dust cocoon stars.

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VOLUME 19 NUMBER 18/SEPTEMBER 23, 1981

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N81-27035# Borst (Henry V.) and Associates, Wayne, Pa.
THE AERODYNAMICS OF THE UNCONVENTIONAL AIR VEHICLES OF A. LIPPISCH
Henry V. Borst 1980 293 p refs
(Contract N00014-76-C-0501; NR Proj. 062-527)
(LC-80-68406) Copyright. Avail: Issuing Activity

The technical background leading to the advanced and unconventional air vehicles of Dr. A. Lippisch are reviewed. The vehicles were designed to improve performance and/or better operational capabilities, such as V/STOL flight and a very high speed capability. The material covers the concepts and methods leading to the innovative vehicle designs and includes procedures and data for their evaluation. The following topics are discussed: physical characteristics of flow; basic theory of design concepts used for the development of V/STOL aircraft; theory and data of wing in ground effect vehicles (WIG); background and theories of Lippisch work; theory of flapping wing flight and devices at the wing tip to improve induced efficiency; recovering vortex energy at the wing tip and methods which permit the calculation of the energy recovery for winglets and associated devices. E.A.K.

N81-27036* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING. A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 136, JUNE 1981
Jun. 1981 132 p
(NASA-SP-7037(136)) Avail: NTIS HC $5.00 CSCL 01A

This bibliography lists 424 reports, articles, and other documents introduced into the NASA scientific and technical information system in May 1981. A.R.H.

N81-27037* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING. A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 135, MAY 1981
May 1981 178 p
(NASA-SP-7037(135)) Avail: NTIS HC $5.00 CSCL 01A

This bibliography lists 536 reports, articles, and other documents introduced into the NASA scientific and technical information system in April 1981. A.R.H.

N81-27038*# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Aeronautical and Astronautical Engineering.
THE DEVELOPMENT OF METHODS FOR PREDICTING AND MEASURING DISTRIBUTION PATTERNS OF AERIAL SPRAYS
Allen I. Ormsbee, Michael B. Bragg, and Mark D. Maughmer Jan. 1981 67 p refs
(Grant NsG-1434)
(NASA-CR-165652; ARL-79-1) Avail: NTIS HC A04/MF A01 CSCL 20D

A set of relationships used to scale small sized dispersion studies to full size results are experimentally verified and, with some qualifications, basic deposition patterns are presented. In the process of validating these scaling laws, the basic experimental techniques used in conducting such studies both with and without an operational propeller were developed. The procedures that evolved are outlined in some detail. The envelope of test conditions that can be accommodated in the Langley Vortex Research Facility, which were developed theoretically, are verified using a series of vortex trajectory experiments that help to define the limitations due to wall interference effects for models of different sizes. E.D.K.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N81-27039*# Cooper Union, New York.
A COMPREHENSIVE MODEL TO DETERMINE THE EFFECTS OF TEMPERATURE AND SPECIES FLUCTUATIONS ON REACTIONS IN TURBULENT REACTING FLOWS Semiannual Status Report
P. J. Antaki 31 Jul. 1981 51 p refs
(Grant NAG1-18)
(NASA-CR-164552) Avail: NTIS HC A04/MF A01 CSCL 01A

The joint probability distribution function (pdf), which is a modification of the bivariate Gaussian pdf, is discussed and results are presented for a global reaction model using the joint pdf. An alternative joint pdf is discussed. A criterion which permits the selection of temperature pdf's in different regions of turbulent, reacting flow fields is developed. Two principal approaches to the determination of reaction rates in computer programs containing detailed chemical kinetics are outlined. These models represent a practical solution to the modeling of species reaction rates in turbulent, reacting flows. E.A.K.

N81-27040# Aircraft Research Association Ltd., Bedford (England).
A REVIEW OF THE EFFECT OF REYNOLDS NUMBER ON AFTERBODY DRAG
O. M. Pozniak May 1980 57 p refs
(ARA-56) Avail: NTIS HC A04/MF A01

The effect of changes in the Reynolds number or boundary layer thickness on afterbody drag were surveyed. The data are applicable to configurations and speed ranges typical of military aircraft. The importance in some instances of tunnel calibrations and part body effects was confirmed but these effects do not account for all observed variations. It is concluded that a better understanding of the reported trends is obtained, after allowing for calibration errors where appropriate, if the significance of

different Mach number regimes and of boattail steepness combinations is recognized. E.A.K.

N81-27041*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

LASER-VELOCIMETER FLOW-FIELD MEASUREMENTS OF AN ADVANCED TURBOPROP

J. S. Serafini, J. P. Sullivan (Purdue Univ., West Lafayette, Ind.), and H. E. Neumann 1981 31 p refs Presented at the 17th Joint Propulsion Conf., Colorado Springs, 27-29 Jul. 1981; sponsored by AIAA, SAE and ASME

(NASA-TM-82677; E-943) Avail: NTIS HC A03/MF A01 CSCL 01A

Non-intrusive measurements of velocity about a spinner-propeller-nacelle configuration at a Mach number of 0.8 were performed. A laser velocimeter, specifically developed for these measurements in the NASA Lewis 8-foot by 6-foot Supersonic Wind Tunnel, was used to measure the flow-field of the advanced swept SR-3 turboprop. The laser velocimeter uses an argon ion laser and a 2-color optics system to allow simultaneous measurements of 2-components of velocity. The axisymmetric nature of the propeller-nacelle flow-field permits two separate 2 dimensonal measurements to be combined into 3 dimensional velocity data. Presented are data ahead of and behind the prop blades and also a limited set in between the blades. Aspects of the observed flow-field such as the tip vortex are discussed. Author

N81-27042*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FACTORS INFLUENCING THE PREDICTED PERFORMANCE OF ADVANCED PROPELLER DESIGNS

Lawrence J. Bober and Li-Ko Chang (Purdue Univ., Lafayette, Ind.) 1981 20 p refs Presented at the 17th Joint Propulsion Conf., Colorado Springs, Colo. 27-29 Jul. 1981; sponsored by AIAA, SAE, and ASME

(NASA-TM-82676; E-942; AIAA-Paper-81-1564) Avail: NTIS HC A02/MF A01 CSCL 01A

The assumptions on which conventional propeller aerodynamic performance analyses are based can be seriously violated when advanced high speed propellers are analyzed. Studies were performed using a lifting line representation for the propeller to determine the sensitivity of predicted propeller performance to various assumptions in the analysis. Items studied include the method of determining blade section lift and the effects of blade section drag, camber and blade sweep. The effects of nonuniform flow into the propeller and compressibility were also studied. Comparisons of analytical and experimental results are presented to demonstrate the overall validity of the results. Author

N81-27043*# National Aeronautics and Space Administration, Washington, D. C.

EXPERIMENTAL STUDY OF THE INTERACTION BETWEEN THE WING OF A SUBSONIC AIRCRAFT AND A NACELLE OF A HIGH BY-PASS RATIO ENGINE

P. Levart Jul. 1981 28 p refs Transl. into ENGLISH of Proceedings of the Fluid Dynamics Panel Symp. (West Germany), 1980 p 20-1 to 20-11 Symp. held in Munich, 5-7 May 1980 Original language document was announced as A80-40803 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by ONERA, Chatillon (France)

(Contract NASw-3198)

(NASA-TM-76606) Avail: NTIS HC A03/MF A01 CSCL 01A

The oncoming of a new generation of subsonic transport aircraft (with supercritical wing and high by-pass ratio turbofans) led to an experimental study of wing nacelle jet pylon interference in transonic flow. To this end, a test set-up was developed at the ONERA S3Ch wind tunnel. The nacelle models represent a turbofan by means of two compressed air jets. The scale is 1/18.5. The nacelles are fixed on a thrust balance measuring afterbody thrust and discharge coefficients. The wing is located between the sidewalls of the test section. Pressures are measured through 456 holes located on 8 airfoils. Drag coefficient of the wing is obtained by wake survey. The following parameters can vary (1) wing/nacelle position; (2) upstream Mach number (from 0.3 to 0.8); (3) jet pressure ratio; (4) with/without pylon and (5) type of nacelle. Wing nacelle interference can be studied by means of total thrust drag analysis as a funcion of the various parameters. The test set-up is described and examples of results are presented. Author

N81-27044*# Nielsen Engineering and Research, Inc., Mountain View, Calif.

COMPUTER PROGRAMS FOR CALCULATING PRESSURE DISTRIBUTIONS INCLUDING VORTEX EFFECTS ON SUPERSONIC MONOPLANE OR CRUCIFORM WING-BODY-TAIL COMBINATIONS WITH ROUND OR ELLIPTICAL BODIES Final Report, 1 Jul. 1976 - 1 Jul. 1978

Marnix F. E. Dillenius and Jack N. Nielsen Washington NASA Apr. 1979 633 p refs

(Contract NAS1-14495)

(NASA-CR-3122; NEAR-TR-154) Avail: NTIS HC A99/MF A01 CSCL 01A

Computer programs are presented which are capable of calculating detailed aerodynamic loadings and pressure distributions acting on pitched and rolled supersonic missile configurations which utilize bodies of circular or elliptical cross sections. The applicable range of angle of attack is up to 20 deg, and the Mach number range is 1.3 to about 2.5. Effects of body and fin vortices are included in the methods, as well as arbitrary deflections of canard or fin panels. Author

N81-27045*# Aeronautical Research Associates of Princeton, Inc., N. J.

A COMPUTATIONAL MODEL FOR THE PREDICTION OF JET ENTRAINMENT IN THE VICINITY OF NOZZLE BOAT-TAILS (THE BOAT CODE)

Sanford M. Dash and Harold S. Pergament Nov. 1978 136 p (Contract NAS1-14794)

(NASA-CR-159001) Avail: NTIS HC A07/MF A01 CSCL 01A

The basic code structure is discussed, including the overall program flow and a brief description of all subroutines. Instructions on the preparation of input data, definitions of key FORTRAN variables, sample input and output, and a complete listing of the code are presented. T.M.

N81-27046*# McDonnell-Douglas Corp., Long Beach, Calif.

DESIGN AND WIND TUNNEL TESTS OF WINGLETS ON A DC-10 WING Final Report

R. D. Gilkey Washington NASA Apr. 1979 52 p refs

(Contract NAS1-14743)

(NASA-CR-3119) Avail: NTIS HC A04/MF A01 CSCL 01A

Results are presented of a wind tunnel test utilizing a 4.7 percent scale semi-span model in the Langley Research Center 8-foot transonic pressure wind tunnel to establish the cruise drag improvement potential of winglets as applied to the DC-10 wide body transport aircraft. Winglets were investigated on both the DC-10 Series 10 (domestic) and 30/40 (intercontinental) configurations and compared with the Series 30/40 configuration. The results of the investigation confirm that for the DC-10 winglets provide approximately twice the cruise drag reduction of wing-tip extensions for about the same increase in bending moment at the wing fuselage juncture. Furthermore, the winglet configurations achieved drag improvements which were in close agreement to analytical estimates. It was observed that relatively small changes in wing-winglet tailoring effected large improvements in drag and visual flow characteristics. All final winglet configurations exhibited visual flow characteristics on the wing and winglets Author

N81-27047*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A POTENTIAL-FLOW/BOUNDARY-LAYER METHOD FOR CALCULATING SUBSONIC AND TRANSONIC AIRFOIL FLOW WITH TRAILING-EDGE SEPARATION

Richard W. Barnwell Jun. 1981 39 p refs

(NASA-TM-81850; L-14255) Avail: NTIS HC A03/MF A01 CSCL 01A

The development of a potential-flow/boundary-layer method for calculating subsonic and transonic turbulent flow past airfoils with trailing-edge separation is reported. A moment-of-momentum integral boundary-layer method is used which employs the law-of-the-wall/law-of-the-wake velocity profile and a two-layer eddy-viscosity model and ignores the laminar sublayer. All integrals

across the boundary layer are obtained in closed form. Separation is assumed to occur when the shearing-stress velocity vanishes. A closed-form solution is derived for separated-flow regions where the shearing stress is negligible. In the potential-flow method, the exact form of the airfoil boundary condition is used, but it is applied at the chord line rather than the airfoil surface. This allows the accurate computation of flow about airfoils at large angles of attack but permits the use of body-oriented Cartesian computational grids. The governing equation for the perturbation velocity potential contains several terms in addition to the classical small-disturbance terms. Author

N81-27048*# Flow Research, Inc., Kent, Wash.
NUMERICAL SOLUTION OF TRANSONIC FULL STREAM FUNCTION EQUATIONS IN CONSERVATION FORM Final Report
Mohamed M. Hafez Oct. 1979 36 p refs
(Contract NAS2-10252)
(NASA-CR-166200; Rept-178) Avail: NTIS HC A03/MF A01 CSCL 01A

The stream function equation in conservation form is solved iteratively based on the artificial compressibility method. The density is not a unique function of the mass flux. In order to avoid the ambiguity near the sonic line, the density is updated in terms of the velocity, which is obtained through a simple integration of a first order equation step by step in the flow field. Iteration algorithms and finite difference approximations are discussed and numerical results of both conservative and nonconservative calculations are presented. E.D.K.

N81-27049*# Purdue Univ., Lafayette, Ind.
FINITE ELEMENT ANALYSIS OF TRANSONIC FLOWS IN CASCADES: IMPORTANCE OF COMPUTATIONAL GRIDS IN IMPROVING ACCURACY AND CONVERGENCE Final Report
Akin Ecer and Hasan U. Akay Washington NASA Jul. 1981 111 p refs
(Grant NsG-3294)
(NASA-CR-3446) Avail: NTIS HC A06/MF A01 CSCL 01A

The finite element method is applied for the solution of transonic potential flows through a cascade of airfoils. Convergence characteristics of the solution scheme are discussed. Accuracy of the numerical solutions is investigated for various flow regions in the transonic flow configuration. The design of an efficient finite element computational grid is discussed for improving accuracy and convergence. Author

N81-27050# Naval Surface Weapons Center, Dahlgren, Va.
AERODYNAMICS OF TACTICAL WEAPONS TO MACH NUMBER 8 AND ANGLE OF ATTACK 180 DEG. PART 1: THEORY AND APPLICATION Final Report
Leroy Devan Oct. 1980 93 p refs
(DA Proj. 1L1-62303-A-214; SR02302001)
(AD-A099795; NSWC/TR-80-346-Pt-1) Avail: NTIS HC A05/MF A01 CSCL 01/1

An existing methodology for predicting static and aerodynamic coefficients was extended to higher angles of attack and Mach numbers. Improvements in existing computational methods were also made. The theory is applicable to bodies of revolution with one or two, piecewise similar-cross section lifting surfaces (2 or 4 number). The original methodology was applicable to a Mach number of 3 and to an angle of attack of 15 deg. The capability for dynamic derivative prediction for small angles was extended and improved to Mach numbers of the order 6, above which real gas effects and much stronger viscous coupling are important. Static aerodynamic prediction capability at small angles of attack was extended and improved to M sub infinity = 6, and empirical code developed for the Army by G. Aiello of the Martin-Marietta Corp. (Orlando) was adapted for prediction of static aerodynamics at higher angles of attack for a limited configurational envelope. The Martin-Marietta code predicts body-tail aerodynamics for arbitrary roll orientation and angles of attack to 45 deg for 0.8 < M sub infinity < 3. Body-alone and wing-along(in the presence of the body) components can be computer to alpha = 180 deg and for 0.8 < M sub infinity < 3. New individual computational methods are evaluated by comparison with other computational methods and experimental data. The resulting extended computer program was segmented in order to conserve storage locations. Computational times depending on Mach number, configuration, and program option range from under a second to a minute per Mach number on the CDC 6700 computer. GRA

N81-27051# Lockheed-Georgia Co., Marietta.
AERODYNAMIC INVESTIGATION OF C-141 LEADING EDGE MODIFICATIONS FOR CRUISE DRAG REDUCTION, TEST 2 Final Report, Oct. 1978 - Aug. 1980
Robert A. Large and W. T. Blackerby Apr. 1981 146 p refs
(AF Proj. 2404)
(AD-A099662; AFWAL-TR-81-3032) Avail: NTIS HC A07/MF A01 CSCL 20/4

A wing leading edge modification for cruise drag reduction on the C-141 aircraft has been designed and wind tunnel tested. The modification was designed using a CONMIN optimizer linked to a transonic airfoil code. It was tested in the AEDC 16-Foot Transonic Facility, using a 0.044 scale C-141B model, to determine the effects of the modifications on C-141 cruise aerodynamic characteristics and wing chordwise pressure distributions. Measured chordwise pressure distributions were used for correlations with transonic theory. Force data results were analyzed to determine the effects on C-141 cruise drag, drag rise, and cruise performance. A fuel savings evaluation was made based on measured cruise performance improvements. The effects of Lockheed designed swept wing tip extensions and trailing edge anti-drag bodies were also investigated in combination with the wing leading edge modification. Author (GRA)

N81-27052# Sandia Labs., Albuquerque, N. Mex. Aeroballistics Div.
PREDICTION OF FORCES AND MOMENTS ON FINNED BODIES AT HIGH ANGLE OF ATTACK AT TRANSONIC FLOW
William L. Oberkampf Apr. 1981 65 p refs
(Contracts DE-AC04-76DP-00789; F08635-77-C-0049)
(SAND-80-2380) Avail: NTIS HC A04/MF A01

The bodies are assumed to be a circular cylinder with cruciform fins (or wings) of arbitrary planform. The bodies can have an arbitrary roll (or bank) angle, and each fin can have individual control deflection. The method combines a body vortex flow model and lifting surface theory to predict the normal force distribution over each fin surface. Extensive comparisons are made between theory and experiment for various planform fins. A description of the use of the computer program that implements the method is given. DOE

N81-27053# Sandia Labs., Albuquerque, N. Mex. Aerothermodynamics Div.
AERODYNAMIC CHARACTERISTICS OF SEVEN SYMMETRICAL AIRFOIL SECTIONS THROUGH 180 DEGREE ANGLE OF ATTACK FOR USE IN AERODYNAMIC ANALYSIS OF VERTICAL AXIS WIND TURBINES
Robert E. Sheldahl and Paul C. Klimas Mar. 1981 120 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-2114) Avail: NTIS HC A06/MF A01

Work on the Darrieus vertical axis wind turbine (VAWT) program is reported. Curved bladed Darrieus turbines which operate at local Reynolds numbers and angles of attack seldom encountered in aeronautical applications are discussed. A wind tunnel test series was conducted. DOE

N81-27054# Sandia Labs., Albuquerque, N. Mex.
AERODYNAMIC INTERFERENCE BETWEEN TWO DARRIEUS WIND TURBINES
P. R. Schatzle, P. C. Klimas, and H. R. Spahr Apr. 1981 38 p refs
(Contract DE-AC04-76DP-00789)
(SAND-81-0896) Avail: NTIS HC A03/MF A01

The effect of aerodynamic interference on the performance of two curved bladed Darrieus type vertical axis wind turbines was calculated using a vortex/lifting line aerodynamic model. the turbines have a tower-to-tower separation distance of 1.5 turbine diameters, with the line of turbine centers varying with respect to the ambient wind direction. The effects of freestream turbulence were neglected. For the cases examined, the calculations showed that the downwind turbine power

decrement (1) was significant only when theline of turbine centers was coincident with the ambient wind direction; (2) increased with increasing tipspeed ratio; and (3) is due more to induced flow angularities downstream than to speed deficits near the downstream turbine. DOE

N81-27055# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Instationaere Aerodynamik.

COMPARATIVE MEASUREMENTS IN FOUR EUROPEAN WIND TUNNELS OF UNSTEADY PRESSURE ON AN OSCILLATING MODEL

Karl Kienappel, Norman C. Lambourne (RAE, Bedford, England), Roger Destuynder (ONERA, Modane, France), and Rudolf Roos (NLR, Amsterdam) Nov. 1980 130 p refs In GERMAN; ENGLISH summary

(DFVLR-FB-80-30; RAE-TR-80016; NLR-TR-80066-U) Avail: NTIS HC A07/MF A01

A program of oscillatory pressure measurements was repeated in four wind tunnels. The influence of tunnel wall interference on flutter and other unsteady tests in transonic wind tunnels was determined. The tunnels differed in the size of their working sections; cross sectional areas ranged from 0.6 to 3.2 m squared. The means of wall ventilation also varied. In each tunnel, small amplitude harmonic oscillations were applied to the same rigid half-model of a low aspect ratio lifting surface. Chordwise distributions of the fundamental components of the oscillatory pressures were measured. Measurements were made of the steady pressure distributions for the mean position about which the oscillations occured. Measurements were also made of the oscillatory pressures at a wall of each tunnel. Two of the tunnels were large compared to the model. Results were in general agreement, suggesting that no serious interference effects occurred. Author (ESA)

N81-27056# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

A NEW FAST ARTIFICIAL EVOLUTION NUMERICAL METHOD FOR TRANSONIC FLOWS IN TURBINE CASCADES

J. A. Essers (Liege Univ.) and F. Kafyeke (Liege Univ.) Dec. 1980 50 p refs

(VKI-TN-136) Avail: NTIS HC A03/MF A01

An isentropic time dependent technique which computes steady transonic inviscid flows in turbine cascades is described. The method consists of the solution of a system of two artificial time dependent equations constructed to obtain a fast convergence to the steady state. The equations are discretized in a conservative form using a finite volume explicit scheme with splitting of the space operators. The technique is tested on turbine blades with a relatively thick rounded supersonic trailing edge. Different models used to apply the Kutta condition and to predict the base pressure accounting for the separation in that region are compared. The quasi natural method is found to be significantly faster than the various classical physical time dependent techniques solving the Euler equations. Author (ESA)

N81-27057# National Aerospace Lab., Amsterdam (Netherlands). Incompressible Aerodynamics Div.

A REVIEW OF RESEARCH AT NLR ON WIND TUNNEL CORRECTIONS FOR HIGH ANGLE OF ATTACK MODELS

R. A. Maarsingh Apr. 1980 38 p refs Presented at AGARD FDP Round Table Discussion, Munich, 8 May 1980

(NLR-MP-80016-U) Avail: NTIS HC A03/MF A01

Wind tunnel wall interference on models at high angles of attack is studied. The problems dealt with are almost exclusively in the low subsonic speed regime. Slotted walls are used to minimize the wall interference gradients over the model. Reliable corrections are derived for the remaining homogeneous wall interference using methods involving measured flow quantities near the walls. Author (ESA)

N81-27058# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

ON THE STRUCTURE OF THE POTENTIAL FLOW FIELD NEAR CONICAL STAGNATION POINTS IN SUPERSONIC FLOW

P. G. Bakker, W. J. Bannink, and J. W. Reyn Feb. 1980 49 p refs

(VTH-LR-293) Avail: NTIS HC A03/MF A01

Flow patterns near conical stagnation points in supersonic flow were investigated on the basis of potential flow. Near the conical stagnation point the nonlinear equation for the conical velocity potential was reduced to the equation of Laplace. Solutions of the equation of Laplace for incompressible plane flow were then used as a guide to generate conical stagnation point solutions. Apart from known types of streamline patterns, such as nodes and saddle points, other types were found. Among them were oblique saddle points, saddle nodes, topological nodes and topological saddle points. Author (ESA)

N81-28045# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

NOISE FROM LONGITUDINAL VORTICES

Robert Legendre *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1981-1, Jan. - Feb. 1981 (ESA-TT-693) May 1981 p 67-68 Transl. by ONERA into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris), no. 1981-1, Jan. - Feb. 1981-1 (For primary document see N81-28038 18-99)

Avail: NTIS HC A04/MF A01; original FRENCH report available at ONERA, Paris FF 45

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N81-27059* National Aeronautics and Space Administration, Washington, D. C.

NASA SATELLITE HELPS AIRLINERS AVOID OZONE CONCENTRATIONS

1981 3 p refs

(NASA-News-Release-81-90; P81-10091) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 01C

Results from a test to determine the effectiveness of satellite data for helping airlines avoid heavy concentrations of ozone are reported. Information from the Total Ozone Mapping Spectrometer, aboard the Nimbus-7 was transmitted, for use in meteorological forecast activities. The results show: (1) Total Ozone Mapping Spectrometer profile of total ozone in the atmosphere accurately represents upper air patterns and can be used to locate meteorological activity; (2) route forecasting of highly concentrated ozone is feasible; (3) five research aircraft flights were flown in jet stream regions located by the Total Ozone Mapping Spectrometer to determine winds, temperatures, and air composition. It is shown that the jet stream is coincides with the area of highest total ozone gradient, and low total ozone amounts are found where tropospheric air has been carried along above the tropopause on the anticyclonic side of the subtropical jet stream. E.A.K.

N81-27060* National Aeronautics and Space Administration, Washington, D. C.

ENERGY ABSORPTION STUDIED TO REDUCE AIRCRAFT CRASH FORCES

20 Jul. 1981 4 p

(NASA-News-Release-81-96; P81-10097) Avail: NTIS Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 01C

The NASA/FAA aircraft safety reseach programs for general aviation aircraft are discussed. Energy absorption of aircraft subflooring and redesign of interior flooring are being studied. The testing of energy absorbing configurations is described. The three NASA advanced concepts performed at neary the maximum possible amount of energy absorption, and one of two minimum modifications concepts performed well. Planned full scale tests are described. Airplane seat concepts are being considered. J.D.H.

N81-27061*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ATC SIMULATION OF HELICOPTER IFR APPROACHES INTO MAJOR TERMINAL AREAS USING RNAV, MLS, AND CDTI

L. Tobias, H. Q. Lee, L. L. Peach, F. M. Willett, Jr. (FAA, Atlantic City), and P. J. OBrien (FAA, Atlantic City) Apr. 1981 55 p refs

(NASA-TM-81301; A-8606) Avail: NTIS HC A04/MF A01 CSCL 01C

The introduction of independent helicopter IFR routes at hub airports was investigated in a real time air traffic control system simulation involving a piloted helicopter simulator, computer generated air traffic, and air traffic controllers. The helicopter simulator was equipped to fly area navigation (RNAV) routes and microwave landing system approaches. Problems studied included: (1) pilot acceptance of the approach procedure and tracking accuracy; (2) ATC procedures for handling a mix of helicopter and fixed wing traffic; and (3) utility of the cockpit display of traffic information (CDTI) for the helicopter in the hub airport environment. Results indicate that the helicopter routes were acceptable to the subject pilots and were noninterfering with fixed wing traffic. Merging and spacing maneuvers using CDTI were successfully carried out by the pilots, but controllers had some reservations concerning the acceptability of the CDTI procedures. Author

N81-27062*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

THUNDERSTORM HAZARDS FLIGHT RESEARCH: STORM HAZARDS 1980 OVERVIEW Technical Report, Jun. - Oct. 1980

Perry L. Deal, Gerald L. Keyser, Bruce D. Fisher, and Norman L. Crabill Jun. 1981 29 p refs

(NASA-TM-81974) Avail: NTIS HC A03/MF A01 CSCL 01C

A highly instrumented NASA F-106B aircraft, modified for the storm hazards mission and protected against direct lightning strikes, was used in conjunction with various ground based radar and lightning measurement systems to collect data during thunderstorm penetration flights. During 69 thunderstorm penetrations, there were 10 direct lightning strikes to the aircraft. No problems were encountered with any of the aircraft's systems as a result of the strikes and the research instrumentation performed as designed. Electromagnetic characteristics of nine strikes were recorded, and the results of other experiments confirm the theory that X-ray radiation and nitrous oxide gas are being produced by processes associated directly with thunderstorm electric fields and lightning discharges. A better understanding of aircraft lightning attachment mechanisms and strike zones is being accomplished by careful inspection, identification, and documentation of lightning attachment points and swept stroke paths following each strike to the aircraft.

A.R.H.

N81-27063*# Battelle Columbus Labs., Ohio.

A STUDY OF ASRS REPORTS INVOLVING GENERAL AVIATION AND WEATHER ENCOUNTERS Interim Report

Thomas H. Rockwell (Ohio State Univ.), Darrell E. Roach (Ohio State Univ.), and Walter C. Griffin (Ohio State Univ.) 26 Jun. 1981 57 p

(Contract NAS2-10060)

(NASA-CR-166212) Avail: NTIS HC A04/MF A01 CSCL 01C

Consideration is given to the nature and characteristics of problems involving dissemination of weather information, use of this information by pilots, its adequacy for the purpose intended, the ability of the air traffic control system to cope with weather related incidents, and the various aspects of pilot behavior, aircraft equipment, and NAVAIDS affecting flights in which weather figures. It is concluded from the study that skill and training deficiencies of general aviation pilots are not major factors in weather related occurrences, nor is lack of aircraft equipment. Major problem causes are identified with timely and easily interpreted weather information, judgement and attitude factors of pilots, and the functioning of the air traffic control system.

E.D.K.

N81-27064# Federal Aviation Administration, Washington, D.C. Office of Aviation Safety.

SPECIAL AVIATION FIRE AND EXPLOSION REDUCTION (SAFER) ADVISORY COMMITTEE, VOLUME 2B Final Report, 26 Jun. 1978 - 26 Jun. 1980

J. H. Enders and E. C. Wood 26 Jun. 1980 194 p

(AD-A099176; FAA-ASF-80-4-Vol-2B) Avail: NTIS HC A09/MF A01 CSCL 01/2

The factors affecting the ability of the aircraft cabin occupant to survive in the post crash fire environment and the range of solutions available are presented. The proceedings of the SAFER Committee and the FAA's responses to the committee's recommendations are reported. Information on crew protection and passenger evacuation is given. T.M.

N81-27065# Federal Aviation Administration, Washington, D.C. Office of Aviation Safety.

SPECIAL AVIATION FIRE AND EXPLOSION REDUCTION (SAFER) ADVISORY COMMITTEE, VOLUME 2A Final Report, 26 Jun. 1978 - 26 Jun. 1980

J. H. Enders and E. C. Wood 26 Jun. 1980 304 p refs

(AD-A099147; FAA-ASF-80-4-Vol-2A) Avail: NTIS HC A14/MF A01 CSCL 01/2

The Special Aviation Fire and Explosion Reduction (SAFER) Advisory Committee and its technical supporting groups spent nearly 13 months from May 1979 through June 1980 examining the factors affecting the ability of the aircraft cabin occupant to survive in the post-crash fire environment and the range of solutions available. Presentations were made to the SAFER Committee by Committee members, technical supporting groups, the FAA, citizens and private firms. The broadly-constituted body of information developed and presented to the Committee formed the basis for Committee Findings and Recommendations. This volume contains technical subcommittee submittal related to interior cabin material's flammability, short term, solutions to the fire hazard and recommendations on Post Crash Fire Reduction. Author (GRA)

N81-27066# Mitre Corp., McLean, Va.

A LOS ANGELES BASIN 1100 AIRCRAFT TRAFFIC MODEL

Anand D. Mundra Washington DOT Jan. 1981 45 p refs

(Contract DTFA01-81-C-10001)

(AD-A100012; MTR-80W329; FAA-RD-81-39) Avail: NTIS HC A03/MF A01 CSCL 01/2

This document describes a static model of air traffic in the Los Angeles basin in the 1995 time frame. The model is a 'snapshot' of a 'peak' instant in 1995, i.e., an instant when the greatest number of aircraft are predicted to be seen at any time in 1995 in the Los Angeles basin. Derived from an earlier model, it contains 1105 instantaneously airborne aircraft. Position, velocity, and other relevant descriptors of each aircraft are provided. The model reflects realistic constraints such as topography, expected airspace restrictions, and aircraft performance characteristics. The total number of aircraft predicted in the model is obtained on the basis of historical data and air traffic projections by the Federal Aviation Administration for the Los Angeles basin. Author (GRA)

N81-27067# Federal Aviation Administration, Washington, D.C. Office of Aviation Safety.

SUMMARY OF FEDERAL AVIATION ADMINSTRATION RESPONSES TO NATIONAL TRANSPORTATION SAFETY BOARD SAFETY RECOMMENDATIONS Quarterly Report, Oct. - Dec. 1980

J. R. Harrison Jan. 1981 264 p

(AD-A099585; FAA-ASF-81-2) Avail: NTIS HC A12/MF A01 CSCL 01/2

This report contains NTSB recommendations and all FAA responses to Board recommendations that were delivered to the Board during the applicable quarter. In addition, the report includes NTSB requests and FAA responses concerning reconsiderations, status reports, and followup actions. The Table of Contents for this report reflects only those NTSB recommendations which are still open pending FAA action (i.e., those that have not been designated as 'Closed' by the NTSB as a result of acceptable action). GRA

N81-27068# Transportation Research Board, Washington, D.C.
AVIATION FORECASTING AND SYSTEMS ANALYSES
R. Wilson, Kenneth E. Geisinger, John R. G. Brander, Frank R. Wilson, Harold M. Kohn, Neil W. Polhemus, Scott D. Nason, Allen C. Busch, Brian Colamosca, and J. Stuart Hunter 1980 65 p refs
(PB81-174252; TRB/TRR-768; ISBN-0-309-03112-5; ISSN-0361-1981) Avail: NTIS HC A04/MF A01 CSCL 01C

A method of allocating airport runway slots; a method for forecasting general aviation activity, and an air traffic control network-planning model based on second-order Markov chains are presented. Other topics analyzing ticket-choice decisions of air travelers; assessing the safety and risk of air traffic control systems: risk estimation from rare events; forecasts of aviation fuel consumption in Virginia; estimating the market share of international air carriers; forecasts of passenger and air-cargo activity at Logan International Airport; and forecasting method for general aviation aircraft and their activity. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N81-27069# Federal Aviation Administration, Washington, D.C. Systems Research and Development Service.
LOCALIZER RANGE RATE MEASUREMENT SYSTEM
Forrest Yetter Mar. 1981 54 p
(AD-A099148; FAA-RD-80-92) Avail: NTIS HC A04/MF A01 CSCL 04/2

The FAA Wind Shear Project Office has determined that groundspeed is a desirable parameter for a wind shear detection system. This report describes range rate measurement equipment that meets both the accuracy and response time requirements for groundspeed on final approach. The cost of the described equipment is considerably less than current shelf hardware, e.g., INS and Doppler navigators, that also meet these measurement requirements. The described system provides one-way differential ranging, operating on the Doppler principal. The localizer carrier antenna pattern is modulated by a 5 KHz precision frequency controlled tone. This signal is received by the aircraft's ILS localizer receiver, and its demodulated tone is processed to measure the Doppler shift of the tone. The unique differential ranging processing method used in this equipment, which accurately measures frequency differences of less than one thousandth of a Hertz, is described in more detail. This system has been successfully flight tested several times, and copies of flight check recordings are shown in this report. GRA

N81-27070# Naval Surface Weapons Center, Dahlgren, Va.
FORMULATION FOR THE NAVSTAR GEODETIC RECEIVER SYSTEM (NGRS) Final Report
Bruce R. Hermann Mar. 1981 64 p refs
(AD-A099829; NSWC/TR-80-348) Avail: NTIS HC A04/MF A01 CSCL 17/7

The NAVSTAR Global Positioning System (GPS) can be used for geodetic applications. The NAVSTAR Geodetic Receiver System (NGRS) has been developed to demonstrate this capability. A brief description of the NGRS hardware is presented along with the formulation that converts the observations of satellite Doppler frequency to range differences. The sensitivity of the range differences to random error sources is also discussed.
Author (GRA)

N81-27071# Federal Aviation Administration, Washington, D.C. Office of Systems Engineering Management.
AN ANALYSIS OF THE REQUIREMENTS FOR AND THE COSTS AND BENEFITS OF THE NATIONAL MICROWAVE LANDING SYSTEM (MLS), VOLUME 1
William C. Reddick, Seymour M. Horowitz, Eugene S. Rehrig, and Gilbert P. Christiana Jun. 1980 345 p refs 2 Vol.
(AD-A099632; FAA-EM-80-7-Vol-1) Avail: NTIS HC A15/MF A01 CSCL 17/7

This report consist of three volumes: (1) An Executive Summary, (2) This Volume I comprising the detailed study analysis, and (3) Volume II which contains reprints of important studies supporting the analysis included in the report. The analysis assesses the comparative desirability of implementing the MLS equipment option in place of the currently installed ILS as the long term National standard for precision guidance service. An evaluation period of 20 years, to the year 2000, was used for this assessment. An implementation strategy was assumed to achieve the estimated National requirement 1250 ground installations by the year 2000 and providing precision guidance service, alternatively, with the ILS or MLS equipment option. The study's method was to examine the technical and performance specifications for the MLS and to estimate the dollar amounts of benefits resulting from the portion of these specifications which could be quantified. The dollar amounts of comparative costs to the community of aviation users and to the FAA from the alternative use of MLS instead of ILS were, likewise, estimated. The study results show that implementation of MLS can provide sizeable benefits in excess of costs, in varying degrees, to the different aviation user groups (i.e., air carriers, commuter airlines, general aviation and the military). Author (GRA)

N81-27072# Federal Aviation Administration, Washington, D.C. Office of Systems Engineering Management.
AN ANALYSIS OF THE REQUIREMENTS FOR, AND THE BENEFITS AND COSTS OF THE NATIONAL MICROWAVE LANDING SYSTEM (MLS), VOLUME 2
William C. Reddick, Seymour M. Horowitz, Eugene S. Rehrig, and Gilbert P. Christiana Jun. 1980 242 p refs 2 Vol.
(AD-A100018; FAA-EM-80-7-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 17/7

The comparative desirability of implementing the MLS equipment option in place of the currently installed ILS as the long term national standard for precision guidance service was assessed. An evaluation period of 20 years, to the 2000, was used for this assessment. Results show that implementation of MLS can provide sizeable benefits in excess of costs, in varying degrees, to the different aviation user groups. T.M.

N81-27073# Federal Aviation Administration, Atlantic City, N.J. Technical Center.
INVESTIGATION OF WILCOX MODEL 585B VERY HIGH FREQUENCY OMNIDIRECTIONAL RADIO RANGE SYSTEM, PART 2 Interim Report, May - Jun. 1980
Wayne Bell and James Dong Apr. 1981 14 p refs
(AD-A099525; FAA-CT-80-45-Pt-2; FAA-RD-80-124-Pt-2) Avail: NTIS HC A02/MF A01 CSCL 17/2

This report establishes a calibration procedure which employs a space modulation chart to adjust percent modulation for the Wilcox 585B very high frequency omnidirectional radio range (VOR) System. This procedure is recommended for solid-state VOR designed systems in which the rotatable goniometer has been replaced by a solid-state unit. Ground and airborne modulation tests were made using a spectrum analyzer for determining percent modulation. Results of these measurements indicated 1.5 percent modulation be added to the normal 30 percent modulation adjustment when made with the detector at counterpoise edge to provide equality between near and far afield modulation measurements. GRA

N81-27074# Sperry Gyroscope Co., Great Neck, N. Y.
NORTH SEEKING GYROCOMPASS Final Technical Report
Jan. 1981 86 p refs
(Contract DAAK70-78-C-0210)
(AD-A100036; SG-4223-1200) Avail: NTIS HC A05/MF A01 CSCL 17/7

This report describes the North Seeking Gyrocompass delivered for evaluation on the M113 armored vehicle. The system consists of a North Finding Module attached to a vehicle mounted gimbal set and a separate Control Panel/Battery Charger. The gyrocompass supplies azimuth to an accuracy of 2 miles RMS approximately 2 minutes after turn-on. Author (GRA)

N81-27487*# AUSTRON, Inc., Austin, Tex.
DESIGN CONSIDERATIONS FOR A LORAN-C TIMING RECEIVER IN A HOSTILE SIGNAL TO NOISE ENVIRONMENT
James W. Porter, J. R. Bowell, and George E. Price *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 417-443 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 17G

N81-27500*# Air Force Systems Command, Norton AFB, Calif. Space Div.
NAVSTAR GLOBAL POSITIONING SYSTEM (GPS) CLOCK PROGRAM: PRESENT AND FUTURE
Douglas M. Tennant *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 703-710 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 17G

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N81-27075*# National Aeronautics and Space Administration, Washington, D. C.
THE SUPERCRITICAL PROFILE OF THE SUPERCRITICAL WING
Otto Wagner Jul. 1981 12 p refs Transl. into ENGLISH from Luft- und Raumfahrt (West Germany), v. 1, 4th quarter, 1980 p 105-106, 108, 109 Original language document was announced as A81-17522 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Technical Univ., Munich
(Contract NASw-3198)
(NASA-TM-76605) Avail: NTIS HC A02/MF A01 CSCL 01C

The profile wing design for supercritical structures is discussed. Emphasis is placed on the flow of air surrounding the wing and variations in flow fields are examined. Modifications to the profile for flight below transonic level are presented that increase the uplift pressure and permit the achievement of critical Mach numbers on the order of 0.85. The uplift pressure along the upper side of the profile is compared for a classical and a Peaky profile. A comparison of classical and supercritical wing cross sections indicates a flatter upper side, a large nose radius, and a thicker profile to the supercritical wing. Author

N81-27076*# Textron Bell Helicopter, Fort Worth, Tex.
TOTAL MAIN ROTOR ISOLATION SYSTEM ANALYSIS
Dennis R. Halwes Jun. 1981 142 p refs
(Contract NAS1-16211)
(NASA-CR-165667) Avail: NTIS HC A07/MF A01 CSCL 01C

The requirements for a preliminary design study and verification procedure for a total main rotor isolation system at n/rev are established. The system is developed and analyzed, and predesign drawings are created for an isolation system that achieves over 95 percent isolation of all six degrees of freedom. Author

N81-27077*# Douglas Aircraft Co., Inc., Long Beach, Calif.
MANUFACTURING DEVELOPMENT OF DC-10 ADVANCED RUDDER Final Report, 6 Dec. 1976 - 1 Sep. 1979
A. Cominsky Aug. 1979 230 p refs
(Contract NAS1-14724)
(NASA-CR-159060) Avail: NTIS HC A11/MF A01 CSCL 01C

The design, manufacture, and ground test activities during development of production methods for an advanced composite rudder for the DC-10 transport aircraft are described. The advanced composite aft rudder is satisfactory for airline service and a cost saving in a full production manufacturing mode is anticipated. L.F.M.

N81-27078*# North Carolina State Univ., Raleigh.
FLIGHT TEST EVALUATION OF PREDICTED LIGHT AIRCRAFT DRAG, PERFORMANCE, AND STABILITY
Frederick O. Smetana and Stan R. Fox May 1979 712 p refs
(Grant NsG-1077)
(NASA-CR-159062) Avail: NTIS HC A99/MF A01 CSCL 01C

A technique was developed which permits simultaneous extraction of complete lift, drag, and thrust power curves from time histories of a single aircraft maneuver such as a pull up (from V max to V stall) and pushover (to V max for level flight). The technique, which is an extension of nonlinear equations of motion of the parameter identification methods of Iliff and Taylor and includes provisions for internal data compatibility improvement as well, was shown to be capable of correcting random errors in the most sensitive data channel and yielding highly accurate results. Flow charts, listings, sample inputs and outputs for the relevant routines are provided as appendices. This technique was applied to flight data taken on the ATLIT aircraft. Lack of adequate knowledge of the correct full throttle thrust horsepower true airspeed variation and considerable internal data inconsistency made it impossible to apply the trajectory matching features of the technique. A.R.H.

N81-27079*# National Aeronautics and Space Administration, Washington, D. C.
PROTECTION AGAINST WING ICING FOR AIRBUS A300 AND A310
G. Woelfer Jul. 1981 30 p ref Transl. into ENGLISH of Vereisungschultz fuer die Traglaechen des Airbus A300 and A310, Brunswick, DGLR Paper 80-046 p 1-34 Presented at the 13th Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Brunswick, 28-30 May 1980 Translation was announced as A80-46296 Transl. by Scientific Translation Service, Santa Barbara Calif. Original document prepared by Messerschmitt-Boelkow-Blohm GmbH
(Contract NASw-3198)
(NASA-TM-76584; HE242-311/80) Avail: NTIS HC A03/MF A01 CSCL 01C

To improve economy of operantion, it is now planned to modify the anti.icing system used on the A300 Airbus wing. Thus, for the A310 Airbus, the deicing system will be applied to only half the wing length. Other essential modifications are a substantial simplification of the warm-air system and discontinuation of the use of a double wall in slats. Author

N81-27080# Nielsen Engineering and Research, Inc., Mountain View, Calif.
PREDICTION OF SUPERSONIC STORE SEPARATION CHARACTERISTICS INCLUDING FUSELAGE AND STORES OF NONCIRCULAR CROSS SECTION. VOLUME 2: USERS MANUAL FOR THE COMPUTER PROGRAM Final Report, Jun. 1975 - Jan. 1980
Joseph Mullen, Jr., Frederick K. Goodwin, and Marnix F. E. Dillenius Wright-Patterson AFB, Ohio AFWAL Nov. 1980 247 p refs
(Contract F33615-76-C-3077; AF Proj. 2403)
(AD-A099391; NEAR-TR-210-Vol-2; AFWAL-TR-80-3032-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 19/5

Detailed instructions are presented for using a computer program which calculates the six-degree-of-freedom trajectories of external stores which are separated from fighter-bomber type aircraft flying at supersonic speeds. Multiple circular or elliptical store configurations may be handled. Parent aircraft configurations may consist of a circular or arbitrary cross section fuselage with ramp external compression inlets, and a wing, pylon, and rack. The program uses linear potential-flow theory to model the wing and pylon loading and thickness. Three-dimensional line sources and doublets are used to model circular fuselages and stores. The noncircular fuselage and elliptic store surfaces are modeled with constant source panels. Nonlinear corrections are made to the wing, fuselage, rack, store and fuselage inlet models to simulate shocks. The program also calculates the trajectory of the store

as it separates from the aircraft. This report describes the program, presents instructions for preparing input for the program, describes the output from the program, and presents a sample case. The program represents an extension of an earlier program restricted to circular bodies at supersonic speeds written by the present authors and described in AFFDL-TR-76-41. This volume presents the instructions for preparing input for each of two programs, a sample case for each, and the descriptions of the output cases. Author (GRA)

N81-27081# Nielsen Engineering and Research, Inc., Mountain View, Calif.

PREDICTION OF SUPERSONIC STORE SEPARATION CHARACTERISTICS INCLUDING FUSELAGE AND STORES OF NONCIRCULAR CROSS SECTION. VOLUME 1: THEORETICAL METHODS AND COMPARISONS WITH EXPERIMENT Final Report, Jun. 1975 - Jan. 1980

Frederick K. Goodwin, Marnix F. E. Dillenius, and Joseph Mullen, Jr. Wright-Patterson AFB, Ohio AFWAL Nov. 1980 331 p refs 4 Vol.

(Contract F33615-76-C-3077; AF Proj. 2403)

(AD-A099330; NEAR-TR-210-Vol-1; AFWAL-TR-80-3032-Vol-1) Avail: NTIS HC A15/MF A01 CSCL 20/4

The primary objective of this report is to describe an investigation conducted to develop a method for predicting the trajectory of a store separated from an aircraft flying at supersonic speeds. The aircraft model can include a circular or noncircular fuselage, engine inlets, wing, pylon, ejector rack, and circular and noncircular stores. The linear, potential flow methods used to model the aircraft components are described as are nonlinear corrections which are made to position shock waves more accurately. The methods used to calculate the nonuniform flow field, the store forces and moments, and the store trajectory are presented. Comparisons between theory and experiment for flow fields, store loading distributions, store forces and moments, and store trajectories are shown and discussed. Author (GRA)

N81-27082# Nielsen Engineering and Research, Inc., Mountain View, Calif.

PREDICTION OF SUPERSONIC STORE SEPARATION CHARACTERISTICS INCLUDING FUSELAGE AND STORES OF NONCIRCULAR CROSS SECTION. VOLUME 3: APPENDICES A AND B. DETAILS OF PROGRAM 1 Final Report, Jun. 1975 - Feb. 1980

Joseph Mullen, Jr., Frederick K. Goodwin, and Marnix F. E. Dillenius Wright-Patterson AFB, Ohio AFWAL Nov. 1980 210 p refs 4 Vol.

(Contract F33615-76-C-3077; AF Proj. 2403)

(AD-A099331; NEAR-TR-210-Vol-3; AFWAL-TR-80-3032-Vol-3) Avail: NTIS HC A10/MF A01 CSCL 20/4

A detailed description of the operations and flow of calculations of each of the individual routines in Program I is provided. Included are a description of the flow of the calculations, including flow charts of some routines, a description of any program arguments, and a program listing. All variables passed between routines in common blocks are also described. A listing of each common block with a description of each variable, array, or index in the common is provided. A special section is given for the multiple uses of blank common as well as a cross reference chart of routine versus common block usage. R.C.T.

N81-27083# Nielsen Engineering and Research, Inc., Mountain View, Calif.

PREDICTION OF SUPERSONIC STORE SEPARATION CHARACTERISTICS INCLUDING FUSELAGE AND STORES OF NONCIRCULAR CROSS SECTION. VOLUME 4: APPENDICES C AND D. DETAILS OF PROGRAM 2 Final Report, Jun. 1975 - Feb. 1980

Joseph Mullen, Jr., Frederick K. Goodwin, and Marnix F. E. Dillenius Wright-Patterson AFB, Ohio AFWAL Nov. 1980 330 p refs 4 Vol.

(Contract F33615-76-C-3077; AF Proj. 2403)

(AD-A099332; NEAR-TR-210-Vol-4; AFWAL-TR-80-3032-Vol-4) Avail: NTIS HC A15/MF A01 CSCL 20/4

Detailed instructions are presented for using a computer program which calculates the six degree of freedom trajectories of external stores which are separated from fighter bomber type aircraft flying at supersonic speeds. The program uses linear potential fow theory to model the wind and pylon loading and thickness. Three dimensional line sources and doublets are used to model circular fuselages and stores. The noncircular fuselage and elliptic store surfaces are modeled with contrast source panels. Nonlinear corrections are made to the wing, fuselage, rack, store and fuselage inlet models to simulate shocks. The program also calculates the trajectories of the store as it separates from the aircraft. R.C.T.

N81-27084# Naval Research Lab., Washington, D. C. Target Characteristics Branch.

RESULTS OF A FEASIBILITY STUDY FOR DETERMINING THE YAW ANGLE OF A LANDING AIRCRAFT Final Report, Jan. 1976 - Oct. 1979

F. Donald Queen and James J. Alter 27 May 1981 19 p refs

(XF21232061)

(AD-A099765; NRL-8480) Avail: NTIS HC A02/MF A01 CSCL 17/9

A study was conducted to determine a means of measuring the yaw angle (crab angle) of an aircraft landing in zero-zero visibility conditions. The results of flight tests using the technique judged most promising are described. This technique used the characteristics of the radar returns obtained when the beam aspects of the aircraft were illuminated with a high-range-resolution radar. The range-time profiles of the sides of the aircraft were processed to determine the delay time between maximum correlation of the two waveforms. This delay is shown to be directly related to the crab angle. While success was achieved using manual data processing, automatic data processing did not produce consistent results when the aircraft geometry was complex. It was concluded that the profiles did not match because of differences in the radar characteristics. A radar technique employing switched RF oscillators is recommended for further testing. Author (GRA)

N81-27085# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.

TORNADO: FLIGHT CHARACTERISTICS AT HIGH ANGLES OF INCIDENCE [TORNADO-FLUGEIGENSCHAFTEN IM HOHEN ANSTELLWINKELBEREICH]

E. P. Hahn and E. Zehner 13 Dec. 1979 47 p refs In GERMAN Presented at DGLR Symp. on the MRCA-Program TORNADO, Neubiberg, West Germany, 13 Dec. 1979

(MBB/FE-127/S/PUB/23) Avail: NTIS HC A03/MF A01

The flight characteristics of the MRCA TORNADO aircraft are assessed from wind tunnel simulations and partial flight test results. The development of spin, spin departure, and spin recovery capabilities are emphasized. The effectiveness of the control surfaces, individually and as a whole, is discussed. Longitudinal and lateral stability are then determined from simulator data. Spin behavior and spin recovery are described. The practicability of spin prevention maneuvers is analyzed. Results show that the pilotage of the TORNADO at high incidence is possible and that spin recovery characteristics are good for this class of fighter aircraft. Author (ESA)

N81-27086# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

LASTING FRIENDSHIP. A REVIEW OF THE F-27 FATIGUE EVALUATION PROGRAM CARRIED OUT BY FOKKER-VFW

J. B. deJonge 27 Jun. 1980 41 p

(Contract RB-RLD/78011)

(NLR-TR-78150-U) Avail: NTIS HC A03/MF A01

A fatigue evaluation of the F-27 aircraft, covering life up to 120,000 flights is described. Included are a complete inventory of the configuration status of the F-27 fleet, an inventory and evaluation of existing test experience, and evaluation of service experience. Analytical predictions of life and fail safe properties and additional fatigue tests are included. Full scale fatigue and fail safe tests are described for fuselage and wing panel specimens. Additional tests are described for outer wing lower skin panels and main landing gear drag strut brackets. Author (ESA)

N81-27087# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
STATE OF THE ART AND STATISTICAL ASPECTS OF HELICOPTER FATIGUE SUBSTANTIATION PROCEDURES
R. Noback Aug. 1980 24 p refs Presented at AGARD Specialist Meeting on Helicopter Fatigue Life Assessment, Aix-en-Provence, France, 14-19 Sep. 1980 Sponsored in part by Sci. Res. Branch Air Mater. Directorate
(NLR-MP-80025-U) Avail: NTIS HC A02/MF A01

The methods used to calculate the safe fatigue life of helicopter components are described. Flight loads are determined for the flight conditions and maneuvers of the mission profiles. The application of the Palmgren-Miner rule and mean load reduction techniques is described. Reduced S-N curve methods in which constant amplitude tests are carried out at various load levels until failure are presented together with the corresponding error analysis. Alternative statistical analyses are compared. Many different ways are available to calculate safe fatigue lives, but there is general agreement on the results obtained. An expression is derived for the reduction factor for the S-N curves. Author (ESA)

N81-27088# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Flight Mechanics Panel.
AIRCRAFT FLIGHT TEST DATA PROCESSING: A REVIEW OF THE STATE OF THE ART
Lawrence J. Smith (Air Force Flight Test Center, Edwards AFB, Calif.) and N. Owen Matthews (Cranfield Inst. of Technol., Bedford, Engl.) Nov. 1980 63 p refs
(AGARD-AG-160-Vol-12; ISBN-92-835-1376-2) Avail: NTIS HC A04/MF A01

A general outline of methods, techniques, and problems associated with data processing is presented. Application of data processing systems to produce data in support of flight testing are described. Data sources, and the considerations required prior to data processing are reviewed. Two major components of data processing, hardware and software, and the people who make it work, are discussed. Data processing in support of flight testing is described according to processing functions and potential problem area are identified. E.A.K.

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N81-27089*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.
BLADE LOSS TRANSIENT DYNAMICS ANALYSIS, VOLUME 1. TASK 1: SURVEY AND PERSPECTIVE Final Report
V. C. Gallardo, E. F. Gaffney, L. J. Bach, and M. J. Stallone Jun. 1981 22 p refs 3 Vol.
(Contract NAS3-22053)
(NASA-CR-165373-Vol-1; R81AEG381-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 21E

An analytical technique was developed to predict the behavior of a rotor system subjected to sudden unbalance. The technique is implemented in the Turbine Engine Transient Rotor Analysis (TETRA) computer program using the component element method. The analysis was particularly aimed toward blade-loss phenomena in gas turbine engines. A dual-rotor, casing, and pylon structure can be modeled by the computer program. Blade tip rubs, Coriolis forces, and mechanical clearances are included. The analytical system was verified by modeling and simulating actual test conditions for a rig test as well as a full-engine, blade-release demonstration. Author

N81-27090*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.
BLADE LOSS TRANSIENT DYNAMICS ANALYSIS, VOLUME 2. TASK 2: THEORETICAL AND ANALYTICAL DEVELOPMENT. TASK 3: EXPERIMENTAL VERIFICATION Final Report
V. C. Gallardo, A. S. Storace, E. F. Gaffney, L. J. Bach, and M. J. Stallone Jun. 1981 250 p refs 3 Vol.
(Contract NAS3-22053)
(NASA-CR-165373-Vol-2; R81AEG381-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 21E

The component element method was used to develop a transient dynamic analysis computer program which is essentially based on modal synthesis combined with a central, finite difference, numerical integration scheme. The methodology leads to a modular or building-block technique that is amenable to computer programming. To verify the analytical method, turbine engine transient response analysis (TETRA), was applied to two blade-out test vehicles that had been previously instrumented and tested. Comparison of the time dependent test data with those predicted by TETRA led to recommendations for refinement or extension of the analytical method to improve its accuracy and overcome its shortcomings. The development of working equations, their discretization, numerical solution scheme, the modular concept of engine modelling, the program logical structure and some illustrated results are discussed. The blade-loss test vehicles (rig full engine), the type of measured data, and the engine structural model are described. A.R.H.

N81-27091*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.
BLADE LOSS TRANSIENT DYNAMICS ANALYSIS. VOLUME 3: USER'S MANUAL FOR TETRA PROGRAM Final Report
G. R. Black, V. C. Gallardo, A. S. Storace, and F. Sagendorph Jun. 1981 239 p ref 3 Vol.
(Contract NAS3-22053)
(NASA-CR-165373-Vol-3; R81AEG381-Vol-3) Avail: NTIS HC A11/MF A01 CSCL 21E

The users manual for TETRA contains program logic, flow charts, error messages, input sheets, modeling instructions, option descriptions, input variable descriptions, and demonstration problems. The process of obtaining a NASTRAN 17.5 generated modal input file for TETRA is also described with a worked sample. A.R.H.

N81-27092*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.
TURBINE BLADE TIP DURABILITY ANALYSIS Final Report
R. L. McKnight, J. H. Laflen, and G. T. Spamer Feb. 1981 120 p refs
(Contract NAS3-22020)
(NASA-CR-165268; R81AEG372) Avail: NTIS HC A06/MF A01 CSCL 21E

An air-cooled turbine blade from an aircraft gas turbine engine chosen for its history of cracking was subjected to advanced analytical and life-prediction techniques. The utility of advanced structural analysis techniques and advanced life-prediction techniques in the life assessment of hot section components are verified. Three dimensional heat transfer and stress analyses were applied to the turbine blade mission cycle and the results were input into advanced life-prediction theories. Shortcut analytical techniques were developed. The proposed life-prediction theories are evaluated. J.D.H

N81-27093*# Pratt and Whitney Aircraft Group, East Hartford, Conn.

ENERGY EFFICIENT ENGINE, HIGH-PRESSURE TURBINE COOLING MODEL TECHNOLOGY REPORT

W. B. Gardner May 1981 37 p

(Contract NAS3-20646)

(NASA-CR-165374; PWA-5594-159) Avail: NTIS HC A03/MF A01 CSCL 21E

Two dimensional flow visualization model tests were used to substantiate the flow stability benefits derived from the use of turning vanes in the root and tip turn flow areas. Results indicate the need for corner fillets and flow injection into the acute corner formed by the intersection of the rib and simulated airfoil suction surface in order to minimize recirculation (stagnation) of flow in that region. Three dimensional flow visualization model tests verified the actual blade coolant passage design. R.C.T.

N81-27094*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE SUPERSONIC FAN ENGINE: AN ADVANCED CONCEPT IN SUPERSONIC CRUISE PROPULSION

Leo C. Franciscus 1981 13 p refs Presented at the 17th Joint Propulsion Conf., Colorado Springs, Colo., 27-29 Jul. 1981; sponsored by AIAA, SAE and ASME

(NASA-TM-82657; E-923) Avail: NTIS HC A02/MF A01 CSCL 21E

Engine performance and mission studies were carried out for turbofan engines equipped with supersonic through-flow fans. The mission was for a commercial supersonic transport with a Mach 2.32 capability. The advantages of the supersonic fan engines are discussed in terms of mission range comparisons with other engine types. The effects of fan efficiency, inlet losses, and engine weight on engine performance and mission range are shown. The range of a supersonic transport with supersonic fan engines could be 10 to 20 percent better than with other types having the same technology core. Author

N81-27095*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

MIXING EFFECTIVENESS TEST OF AN EXHAUST GAS MIXER IN A HIGH BYPASS TURBOFAN AT ALTITUDE

R. R. Cullom, G. A. Bobula, and L. A. Burkardt 1981 13 p refs Presented at the 17th Joint Propulsion Conf., Colorado Springs, Colo., 27-29 Jul. 1981; sponsored by AIAA, SAE and ASME

(NASA-TM-82663; AVRADCOM-TR-81-C-24; E-938) Avail: NTIS HC A02/MF A01 CSCL 21E

Thermal mixing effectiveness characteristics of an eighteen lobe, scalloped and unscalloped, partial, forced mixer were measured in a high-bypass turbofan engine. Data were also obtained without the mixer installed, i.e., free mixing. Tests were conducted at four combinations of simulated flight conditions from 0.3 to 0.8 Mach number and from 6,096 meters (20,000 ft) to 13,715 m (45,000 ft) altitude, mixing chamber lengths of $L/D = 0.52$ and 0.65 were tested. For this range of test conditions and mixer configurations, the forced mixing effectiveness varied from 59 to 68 percent. Values of mixing effectiveness and total pressure loss were calculated from temperature and pressure data obtained at the mixer inlet and exhaust nozzle exit. Author

N81-27096*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

WINGTIP VORTEX TURBINE Patent Application

James C. Patterson, Jr., inventor (to NASA) Filed 16 Mar. 1981 14 p

(NASA-Case-LAR-12544-1; US-Patent-Appl-SN-243685) Avail: NTIS HC A02/MF A01 CSCL 01C

Means of extracting rotational energy from the vortex created at aircraft wing tips, of a turbine with four blades which are located in the cross flow of the vortex and attached downstream of the wing tip are described. The turbine blades are attached to a core. When the aircraft is in motion, the rotation of the core transmits energy to a centrally attached shaft. The rotational energy thus generated is utlized within the airfoil or aircraft fuselage. E.A.K.

N81-27097*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE); ACOUSTIC PERFORMANCE OF A 50.8-cm (20 INCH) DIAMETER VARIABLE PITCH FAN AND INLET, TEST RESULTS AND ANALYSIS, VOLUME 1 Final Report

K. R. Bilwakesh, A. Clemons, and D. L. Stimpert Apr. 1979 306 p refs

(Contract NAS3-18021)

(NASA-CR-135117; R77AEG229-Vol-1) Avail: NTIS HC A14/MF A01 CSCL 21E

Tests were run both in forward and in reverse thrust modes with a bellmouth inlet, five accelerating inlets (one hard wall and four treated) with a design throat Mach number of 0.79 at the takeoff condition, and four low Mach inlets (one hard wall and three treated) with a design throat Mach number of 0.6 at the takeoff condition. Unsuppressed and suppressed inlet radiated noise levels were measured at conditions representative of QCSEE takeoff, approach, and reverse thrust operations. Measured aerodynamic performance of the accelerating inlet is also included. The test objectives, facility, configurations, are described as well as the data analysis, results, and comparisons. A.R.H.

N81-27098*# AiResearch Mfg. Co., Phoenix, Ariz.

ABRADABLE COMPRESSOR AND TURBINE SEALS, VOLUME 2

D. V. Sundberg, R. E. Dennis, and L. G. Hurst Jul. 1979 53 p 2 Vol.

(Contract NAS3-20073)

(NASA-CR-159662; AiResearch-21-3213-2; PCRP-2) Avail: NTIS HC A04/MF A01 CSCL 21E

The applications and advantages of abradable coatings as gas path seals in a general aviation turbofan engine were investigated. Abradable materials were evaluated for the high pressure radial compressor and the axial high and low pressure turbine shrouds. T.M.

N81-27099*# Hamilton Standard, Windsor Locks, Conn.

PERFORMANCE AND NOISE OF A LOW PRESSURE RATIO VARIABLE PITCH FAN DESIGNED FOR GENERAL AVIATION APPLICATIONS Final Report

F. B. Metzger, R. W. Menthe, and C. J. McColgan 31 Jan. 1980 105 p refs

(Contract NAS1-13774)

(NASA-CR-159246) Avail: NTIS HC A06/MF A01 CSCL 01C

A limited study has been conducted to establish the performance and noise characteristics of a low design tip speed (168 m/s, 550 ft/sec) low pressure ratio (1.04) variable pitch fan which was tested in the Langley 30 X 60 tunnel. This fan was designed for minimum noise when installed in the tail mount location of a twin engine aircraft which normally has both nose and tail mounted propulsors. Measurements showed the fan noise to be very close to predictions made during the design of the fan and extremely low in level (65 dBA at 1000 ft) with no acoustic treatment. This is about 8 dB lower than the unshrouded 2 blade propeller normally used in this installation. On the basis of tests conducted during this program, it appears that this level could be further reduced by 2 dBA if optimized acoustic treatments were installed in the fan duct. Even the best of the shrouded propellers tested previously were 7 dB higher in level than the Q-Fan without acoustic treatment. It was found that the cruise performance of this fan was within 5% of the predicted efficiency of 72%. Evaluation of the performance data indicated that disturbances in the inflow to the fan were the probable cause of the reduced performance. E.D.K.

N81-27100# Vought Corp., Dallas, Tex.

POWER SYSTEM CONTROL STUDY. PHASE 1: INTEGRATED CONTROL TECHNIQUES. PHASE 2: DETAIL DESIGN AND SYSTEM MODELING Final Report, 15 Jun. 1978 - 15 Sep. 1980

D. E. Lautner, A. J. Marek, J. R. Perkins, and D. F. Sellers Wright-Patterson AFB, Ohio AFWAL Mar. 1981 449 p refs

(Contract F33615-78-C-2018; AF Proj. 3145)

(AD-A099894; AFWAL-TR-80-2129) Avail: NTIS HC A19/MF A01 CSCL 10/2

This report documents the results of a two phase program

which addresses the integration of advanced power system control technologies into a reliable and fault tolerant system. The advanced control technologies integrated include: electric engine start, automatic load management, microprocessor control implementations, design techniques for providing no-gap power and an all solid state electric power distribution system. Electric system performance requirements are established and preliminary designs of an integrated baseline control system for single and multi-engine aircraft for the 1990 operational time period are presented. Finally, a detail design was performed for a single and a multiple engine electric system. Analytical models and computer programs were developed for the IDG and VSCF implemented electrical systems. A users guide for each of the programs was prepared. Simulation runs of typical electrical system operations were made on the computer graphics system and included in the final engineering report. GRA

N81-27101# Feldmuehle A.G., Plochingen (West Germany). Werk Suedplastik und -Keramik Plochingen.

DEVELOPMENT OF A FORMING PROCESS FOR GAS TURBINE COMPONENTS MADE OF SILICON NITRIDE Final Report, May 1977

Ulf Dworak and Hans Olapinski Bonn Bundesministerium fuer Forschung und Technologie Jun. 1980 15 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-80-02; ISSN-0340-7608; BMFT-NTS0003; BMFT-01ZC014/NTS1002) Avail: NTIS HC A02/MF A01

An injection molding process was elaborated for the manufacture of gas turbine parts of complex shape, e.g., turbine blades, made of densified silicon powder. Reaction sintering was used to improve the mechanical properties of the Si3N4 components. Homogeneity, density and strength characteristics were determined. Oxidation stability was examined. Development test results indicate that faultless, reproducible molded parts of complex shape, can be produced up to volumes of 65 ccm. Room temperature strength of 200 N/mm squared (four points) and densities of 2.56 to 2.60 g/ccm are reported. Author (ESA)

N81-27102# Annawerk Keramische Betriebe G.m.b.H., Roedental (West Germany). Geschaeftsbereich Ceranox.

DEVELOPMENT OF HIGH STRENGTH SILICON CARBIDE MATERIALS FOR GAS TURBINE APPLICATIONS Final Report

Ernst Gugel and Gerhard Leimer Bonn Bundesministerium fuer Forschung und Technologie Jul. 1980 77 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerum fuer Forschung und Technologie

(BMFT-FB-T-80-025; ISSN-0340-7608; BMFT-01ZA005/NTS1003) Avail: NTIS HC A05/MF A01

The processing of silicon carbides was undertaken in order to develop materials suitable for manufacturing gas turbine ceramic parts. Dense SiC sintered without pressure, SiC containing densified silicon, and reaction bonded SiC were investigated. Forming techniques appropriate to manufacturing gas turbine components were defined. Turbine blades, blade rims, engine inlet nose cones, combustors, and turbine rotors were produced. Mechanical properties were measured, and component quality was determined experimentally. Results confirm that these materials conform to gas turbine standards. Author (ESA)

N81-27103# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

MICROCOMPUTER APPLICATIONS IN POWER AND PROPULSION SYSTEMS

Mar. 1981 156 p refs Lecture Ser. held in London, 2-3 Apr. 1981, Oberpfaffenhofen, West Germany, 6-7 Apr. 1981, and Genoa, 9-10 Apr. 1981

(AGARD-LS-113; ISBN-92-835-1381-9) Avail: NTIS HC A08/MF A01

Topics include microprocessor characteristics by manufacturer, memory characteristics, software HI and LO level language tradeoffs, and sensor and actuator interfacing. Control logic design methods, redundancy management, and a description of several current applications to engine control are also discussed. For individual titles, see N81-27104 through N81-27112.

N81-27104# Lucas Aerospace Ltd., Birmingham (England).

MICROPROCESSOR CHARACTERISTICS AND COMPARATIVE FEATURES

R. G. Burrage *In* AGARD Microcomputer Appl. in Power and Propulsion Systems Mar. 1981 17 p (For primary document see N81-27103 18-07)

Avail: NTIS HC A08/MF A01

A modern design of control for a gas turbine is used to introduce the concept of computer control. This shows the function of the microprocessor, which associated circuits are needed to complete the control, and the features of the microprocessor that suit it to control tasks. Many tasks other than control can be undertaken by microprocessors. These are discussed to establish which general features are of importance to propulsion systems. These features, plus the normal criteria applied to the procurement of any component, can be used as a guide to the selection of a microprocessor. Comparisons are made of different manufacturer's product using this approach. E.D.K.

N81-27105# Naval Air Propulsion Test Center, Trenton, N.J. Advanced Development Div.

THE PACKAGING OF ELECTRONIC ENGINE CONTROL UNITS AND RELATED SUBCOMPONENTS

R. W. Vizzini *In* AGARD Microcomputer Appl. in Power and Propulsion Systems Mar. 1981 34 p refs (For primary document see N81-27103 18-07)

Avail: NTIS HC A08/MF A01

The data evaluated in this study leads to the engine mounted electronic control system with a choice between two versions; air cooled and fuel cooled. When maintainability, reliability, survivability, vulnerability, safety and life cycle cost are considered, there is no clear choice between an air cooled engine mounted control and a fuel cooled engine mounted control. The air cooled version could be selected based on the slight survivability/vulnerability and safety benefits and the fuel cooled version on the basis of weight and cost benefits. Clearly the two systems are both acceptable and the final decision on configuration must be considered a designer's choice, driven by the overriding selection criteria for the particular aircraft. E.D.K.

N81-27106# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

ALGORITHM DESIGN FOR DIGITAL FEEDBACK CONTROL SYSTEMS

J. David Powell *In* AGARD Microcomputer Appl. in Power and Propulsion Systems Mar. 1981 13 p refs (For primary document see N81-27103 18-07)

Avail: NTIS HC A08/MF A01

The various design methods available to obtain control equations suitable for programming in the microprocessor are described. In order to analyze and compare the methods, the z-transform is discussed and the correspondence between the z and s planes established. There are two broad categories of design methods: (1) continuous design followed by a digitization and (2) direct design. The various digitization methods for the first design category are described and compared in terms of design ease and accuracy. The second category, direct digital design, is described and compared to the first category in terms of design ease and accuracy. Small word size effects and the basic issues in selecting the sample rate are addressed. E.D.K.

N81-27107# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.

PROPULSION CONTROL SYSTEM COMPUTER SOFTWARE DEVELOPMENT AND MANAGEMENT

R. J. Miller and W. J. Barrett *In* AGARD Microcomputer Appl. in Power and Propulsion Systems Mar. 1981 12 p refs (For primary document see N81-27103 18-07)

Avail: NTIS HC A08/MF A01

An overview of the major software development requirements for an advanced propulsion control system is presented. The methodology described provides systematic design discipline and program visibility. As part of the software requirements preparation, a top-down process based on modular techniques was defined that results in functionally balanced partitioning of the operating program. The resulting software organization is easily comprehended. The combination of high level languages and fully matured support software provides an effective development tool

as well as a means to document the system logic implementation. Strategically timed program reviews keep the development activities on schedule and major design issues in perspective. Configuration control and documentation procedures span the entire software life cycle. Finally, subsystem and engine tests assure that the software and hardware are compatible and that the system is ready for production release. E.D.K.

N81-27108# Smiths Industries Ltd., Basingstoke (England). Aerospace and Defence Systems.
MICROPROCESSOR SYSTEM TEST AND MONITORING
J. F. O. Evans *In* AGARD Microcomputer Appl. in Power and Propulsion Systems Mar. 1981 8 p (For primary document see N81-27103 18-07)
Avail: NTIS HC A08/MF A01

Digital control systems for aircraft jet engines require extensive and careful development testing if they are to meet the rigorous performance and safety requirements of the engine and airframe manufacturers and air certification authorities. In order to achieve the level of testing required whilst minimizing expensive engine running hours, relatively sophisticated test procedures and equipment are required. These tests need to cover the system hardware, real time operating system software, and control software. The development of the required testing techniques and the current equipment and procedures are described. E.D.K.

N81-27109# Smiths Industries Ltd., Basingstoke (England). Aerospace and Defence Systems.
FAULT TREES AND SYSTEM RELIABILITY ANALYSIS WITH REFERENCE TO THE CONTROL OF AIRCRAFT ENGINES
J. F. O. Evans *In* AGARD Microcomputer Appl. in Power and Propulsion Systems Mar. 1981 16 p refs (For primary document see N81-27103 18-07)
Avail: NTIS HC A08/MF A01

Control systems for aircraft engines are very precisely and stringently specified with respect to performance and safety. At the same time there is a real need to minimize cost and weight and to improve reliability. These requirements may conflict unless the overall system organization is very carefully designed and proven. It is not possible to prove that the safety requirements were met within the acceptable confidence level by testing alone. Hence, testing needs to be backed up by safety analysis. Current engine control systems organizations, the related analysis techniques, such as fault trees, and some of the special difficulties associated with analyzing systems which include multitask processors are discussed. E.D.K.

N81-27110# Politecnico di Milano (Italy). Ist. di Elettrotecnica ed Elettronica.
FAULT TOLERANT SOFTWARE PROGRAMMING
Vito Amoia and Mariagiovanna Sami *In* AGARD Microcomputer Appl. in Power and Propulsion Systems Mar. 1981 11 p refs (For primary document see N81-27103 18-07)
Avail: NTIS HC A08/MF A01

The reliability of a control system equipped with a microprocessor is dependent both on safe operation of its hardware and on ability of its software to correctly implement the operations required. The two traditional approaches are discussed: fault tolerant and fault intolerant. Some significant examples of system fault tolerance implemented by software mechanism are included. Basic techniques for reliable software are presented. Validation and testing methodologies are outlined. Emphasis is given to the most recent fault tolerant approach. E.D.K.

N81-27111# Laboratoire d'Automatique et d'Analyse des Systemes, Toulouse (France).
DESIGN OF SECURE AND MODULAR MICROCOMPUTERS FOR ENGINE CONTROL
C. Beounes, J. C. Laprie, and J. M. Collin (SNECMA, Seresnes, France) *In* AGARD Microcomputer Appl. in Power and Propulsion Systems Mar. 1981 22 p refs (For primary document see N81-27103 18-07)
Avail: NTIS HC A08/MF A01

The large scale integration circuits available provide designers with possibilities for the rational definition of digital automated devices integrated in the power plant control system. In designing these automated devices, the following factors must be taken into consideration: functional specification, operational specifications, especially those related to reliability and mission safety, and technological constraints imposed by adverse environments. A systematic design methodology is summarized and some special purpose microcomputers for turbojet engine control are described. E.D.K.

N81-27112# Naval Air Propulsion Test Center, Trenton, N.J. Advanced Development Div.
FULL AUTHORITY DIGITAL ELECTRONIC CONTROL TURBOFAN ENGINE DEMONSTRATION
R. W. Vizzini, T. G. Lenox (Pratt and Whitney Aircraft Group, East Hartford, Conn.), and R. J. Miller (Pratt and Whitney Aircraft Group, West Palm Beach, Fla.) *In* AGARD Microcomputer Appl. in Power and Propulsion Systems Mar. 1981 10 p (For primary document see N81-27103 18-07)
Avail: NTIS HC A08/MF A01

The design, demonstration and evaluation of a Full Authority Digital Electronic Control (FADEC) capable of controlling an advanced variable cycle gas turbine engine in an advanced supersonic Navy fighter aircraft application is described. The FADEC design incorporates many advanced technology features including the latest microelectronics, extensive fault tolerance capability, and high speed digital communication using a fiber optic link. The advanced technology FADEC system was successfully demonstrated in a comprehensive test program, which included open loop environmental bench testing, closed loop bench testing, and testing on an F401 afterburning turbofan engine at sea level and at nine altitude conditions from 7000 to 50,000 ft, and at Mach numbers from 0.3 to 1.6. Over 7000 hr of electronic control operation were achieved during this program. Over 1100 hr of testing were achieved with the engine mounted control unit, which included over 68 hr of engine testing without a hardware malfunction. In addition to the advanced electronic circuitry employed in the FADEC, the first demonstration of optic communication with engine mounted equipment was achieved. E.D.K.

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N81-27113*# Systems Technology, Inc., Hawthorne, Calif.
ANALYSES OF SHUTTLE ORBITER APPROACH AND LANDING CONDITIONS Final Contractor Report
Gary L. Teper, Richard J. Dimarco, Irving L. Ashkenas, and Roger H. Hoh Jul. 1981 136 p refs
(Contract NAS4-2581)
(NASA-CR-163108; TR-1137-1) Avail: NTIS HC A07/MF A01 CSCL 01C

A study of one shuttle orbiter approach and landing conditions are summarized. Causes of observed PIO like flight deficiencies are identified and potential cures are examined. Closed loop pilot/vehicle analyses are described and path/attitude stability boundaries defined. The latter novel technique proved of great value in delineating and illustrating the basic causes of this multiloop pilot control problem. The analytical results are shown to be consistent with flight test and fixed base simulation. Conclusions are drawn relating to possible improvements of the shuttle orbiter/digital flight control system. R.C.T.

N81-27114*# Boeing Military Airplane Development, Wichita, Kans.
FINAL DESIGN AND FABRICATION OF AN ACTIVE CONTROL SYSTEM FOR FLUTTER SUPPRESSION ON A SUPERCRITICAL AEROELASTIC RESEARCH WING
G. E. Hodges and C. R. McGehee Jun. 1981 396 p refs
(Contract NAS1-14675)
(NASA-CR-165714; D3-11536-1) Avail: NTIS HC A17/MF A01 CSCL 01C

The final design and hardware fabrication was completed for an active control system capable of the required flutter suppression, compatible with and ready for installation in the

NASA aeroelastic research wing number 1 (ARW-1) on Firebee II drone flight test vehicle. The flutter suppression system uses vertical acceleration at win buttock line 1.930 (76), with fuselage vertical and roll accelerations subtracted out, to drive wing outboard aileron control surfaces through appropriate symmetric and antisymmetric shaping filters. The goal of providin an increase of 20 percent above the unaugmented vehicle flutter velocity but below the maximum operating condition at Mach 0.98 is exceeded by the final flutter suppression system. Results indicate that the flutter suppression system mechanical and electronic components are ready for installation on the DAST ARW-1 wing and BQM-34E/F drone fuselage. R.C.T.

N81-27115*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A DIGITAL PROGRAM FOR CALCULATING THE INTERACTION BETWEEN FLEXIBLE STRUCTURES, UNSTEADY AERODYNAMICS AND ACTIVE CONTROLS
Ellwood L. Peele and William M. Adams, Jr. Jan. 1979 57 p refs
(NASA-TM-80040) Avail: NTIS HC A04/MF A01 CSCL 01C

A computer program, ISAC, is described which calculates the stability and response of a flexible airplane equipped with active controls. The equations of motion relative to a fixed inertial coordinate system are formulated in terms of the airplane's rigid body motion and its unrestrained normal vibration modes. Unsteady aerodynamic forces are derived from a doublet lattice lifting surface theory. The theoretical basis for the program is briefly explained together with a description of input data and output results. Author

N81-27116*# Boeing Commercial Airplane Co., Seattle, Wash.
THE 747 PRIMARY FLIGHT CONTROL SYSTEMS RELIABILITY AND MAINTENANCE STUDY Final Report, Aug. 1977 - Jul. 1978
Apr. 1979 205 p refs
(Contract NAS1-14742)
(NASA-CR-159010; D6-46350) Avail: NTIS HC A10/MF A01 CSCL 01C

The major operational characteristics of the 747 Primary Flight Control Systems (PFCS) are described. Results of reliability analysis for separate control functions are presented. The analysis makes use of a NASA computer program which calculates reliability of redundant systems. Costs for maintaining the 747 PFCS in airline service are assessed. The reliabilities and cost will provide a baseline for use in trade studies of future flight control system design. Author

N81-27117# Systems Technology, Inc., Hawthorne, Calif.
DEVELOPMENT OF HANDLING QUALITY CRITERIA FOR AIRCRAFT WITH INDEPENDENT CONTROL OF SIX DEGREES OF FREEDOM Final Report, Oct. 1978 - Jul. 1980
Roger H. Hoh, Thomas T. Myers, Irving L. Ashkenas, Robert F. Ringland, and Samuel Craig Apr. 1981 252 p refs
(Contract F33615-78-C-3616; AF Proj. 2403)
(AD-A100045; STI-TR-1135-1; AFWAL-TR-81-3027) Avail: NTIS HC A12/MF A01 CSCL 01/4

A tentative flying quality criterion has been developed for aircraft with direct force controls which allow independent control over the six inertial degrees of freedom. The criterion is based on analysis of existing flight test and simulation data as well as the results of an abbreviated flight test conducted during the program. Author (GRA)

N81-27118# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
DETERMINATION OF LOW-SPEED LONGITUDINAL MANEUVERING CRITERIA FOR TRANSPORT AIRCRAFT WITH ADVANCED FLIGHT CONTROL SYSTEMS
H. A. Mooij, W. P. deBoer, and M. F. C. Vangool 20 Dec. 1979 157 p refs
(Contracts NIVR-1745; RB-RLD-1977:1.3.1; RB-RLD-77017; RB-RLD-77017/1; RB-RLD-1978:1.3; RB-RLD-78017; RB-RLD-78017/1)
(NLR-TR-79127-U) Avail: NTIS HC A08/MF A01

The application of active control technology concepts and in particular the relaxed static stability principle to certain categories of transport aircraft is addressed. Approach and landing flight simulation investigations were performed, using a moving-base flight simulator with simulated outside view. A jet transport conceptual aircraft developed around the relaxed static stability concept and equipped with a primary flight control system of the rate-command/attitude-hold type for pitch and roll control was simulated. Boundaries for satisfactory handling qualities were established from pilot/aircraft performance, pilot ratings and pilot commentaries for a number of handling quality criteria. A criterion on closed loop resonance and pilot compensation (Neal-Smith criterion), related to the pitch attitude control loop is identified as the best format for short period pitch dynamics. Author (ESA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N81-27119*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A SUMMARY OF TESTS ON INVAR WELDED WITH 308L AND 8N12 WELDING RODS
John W. Cox Jun. 1981 35 p refs
(NASA-TM-83119) Avail: NTIS HC A03/MF A01 CSCL 14B

The cost and difficulty in obtaining Invarod, the recommended welding rod to weld Invar, nessitated the investigation of substituting more readily available rods that would meet the cryogenic design criteria for the National Transonic Facility (NTF). Two weld rods, 308L and 8N12, were chosen as promising candidates. Four welded specimen plates were made; two plates for each type of weld rod. One plate from each of the 308L and 8N12 weldings was thermally cycled 50 times between 366 K and 89 K while the two remaining plates were not thermally cycled. Specimens were machined from all four plates for three types of tests: tensile, charpy impact, and guided-bend. The methods in making the specimen plates, conduction of the tests, test results, and conclusions leading to the selection of a weld rod are presented. Author

N81-27120*# National Bureau of Standards, Boulder, Colo. Fracture and Deformation Div.
MATERIALS FOR CRYOGENIC WIND TUNNEL TESTING
R. L. Tobler May 1980 135 p refs Sponsored by NASA
(NASA-CR-164556; NBSIR-79-1624) Avail: NTIS HC A07/MF A01 CSCL 14B

A study was conducted to guide the evaluation and selection of materials and techniques to be used in construction of model aircraft for cryogenic wind tunnel testing. In this report, the mechanical, thermal, and electrical property behavior of materials at temperatures as low as 77 K is briefly reviewed. Metals, structural alloys, non-metals, composites, joining methods, coatings, sealants, adhesives, contact agents, lubricants, transducers, and instrumentation for cryogenic applications are discussed. Acceptable structural materials, conductors, and insulators are discussed for service at temperatures in the range 367 to 77 K. Numerous references to handbooks and other cryogenic data sources are cited as a guide to additional information. Author

N81-27121*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A SELF-CORRECTING ELECTRONICALLY SCANNED PRESSURE SENSOR Patent Application
Chris Gross, inventor (to NASA) Filed 31 Mar. 1981 11 p
(NASA-Case-LAR-12686-1; US-Patent-Appl-SN-249304) Avail: NTIS HC A02/MF A01 CSCL 14B

A multiple-channel high data rate pressure sensing device for use in wind tunnels, spacecraft, airborne, process control, automotive, pressure measurements, etc., is described. The device

offers data rates in excess of 100,000 measurements per second with inaccuracies from temperature shifts less than 0.25% of full scale over a temperature span of 55 C. The device consists of 32 solid state sensors, signal multiplexing electronics to electronically address each sensor, and digital electronic circuitry to automatically correct the inherent thermal shift errors of the pressure sensors and their associated electronics. NASA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N81-27122* National Aeronautics and Space Administration, Washington, D. C.
NASA AND DEERE TO STUDY EFFECTS OF LOW-g ON IRON PROCESSING
2 Jul. 1981 3 p refs
(NASA-News-Release-81-89; P81-10090) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

A technical exchange agreement to study the effects of processing iron alloys in microgravity is described. Alloy solidification experiments are to be performed in the low-g facilities at Marshall Space Center. Deere is to prepare and evaluate the samples, and perform thermal characterization studies of the furnace used for melting and solidifying the samples. Experiment planning and analysis are to be performed jointly and data shared between the two parties. The technical exchange concept, developed by NASA to involve the private sector in low gravity research programs, is described. Other low gravity processing fields in which industry is invited to participate are listed. J.D.H.

N81-27123*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE TELECOMMUNICATIONS AND DATA ACQUISITION REPORT Progress Report, Mar. - Apr. 1981
N. A. Renzetti, ed. 15 Jun. 1981 232 p refs Sponsored by NASA
(NASA-CR-164542; JPL-PR-42-63) Avail: NTIS HC A11/MF A01 CSCL 22D

Developments in Earth-based ratio technology as applied to the Deep Space Network are reported. Topics include ratio astronomy and spacecraft tracking networks. Telemetric methods and instrumentation are described. Station control and system technology for space communication is discussed. Special emphasis is placed on network data processing. For individual titles, see N81-27124 through N81-27149.

N81-27124*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADIO ASTRONOMY **c89**
R. D. Shaffer, P. R. Wolken, and S. Gulkis *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 1-2 (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 03A

The activities of the Deep Space Network in support of radio astronomy operations during the first quarter of 1981 are reported. Results of the use of a low noise maser are presented, as well as updates in DSN support of experiments sanctioned by the Radio Astronomy Experiment Selection Panel. T.M.

N81-27125*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MARK 4-A DSCC TELEMETRY SYSTEM DESCRIPTION **c17**
R. Burt *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 3-7 ref (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 09F

This system is designed as a replacement for the Mark III. Two major changes in the DSCC portion of the DSN Telemetry System are discussed: the addition of two 34 meter antennas to each DSCC; and the configuration of the telemetry system. The telemetry system is configured to support either two deep space missions and one highly elliptical orbit, or two highly elliptical orbits and one deep space mission. T.M.

N81-27126*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE DSN TRACKING SYSTEM **c14**
J. A. Wackley *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 8-15 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

A description of the functions of the tracking system is presented. Extensive software and hardware changes are reported. T.M.

N81-27127*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PIONEERS 6 THROUGH 12 MISSION SUPPORT **c14**
R. Nevarez *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 16-17 (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

The Deep Space Network support of Pioneer Mission Operations during the cruise phases of Pioneers 6 through 9, Pioneer 10, Pioneer 11, and the orbital operations of Pioneer 12 spacecrafts is described. All Pioneer spacecraft appear in good health and are operating nominally. Tracking coverage from June 1980 through March 1981 is shown. T.M.

N81-27128*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VOYAGER MISSION SUPPORT **c14**
N. Fanelli and H. Nance *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 19-21 (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

The Deep Space Network Report on Tracking and Data Acquisition for Project Voyager is presented. Long time base observation and system scans are described. Results of adaptive tracking techniques on Voyager 2 are reported. The reporting period is December 1980 through March 1981. T.M.

N81-27129*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NAVIGATION USING X-RAY PULSERS **c17**
T. J. Chester and S. A. Butman *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 22-25 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 22A

Approximately one dozen X-ray pulsars are presently known which emit strong stable pulses with periods of 0.7 to approximately 1000 s. By comparing the arrival times of these pulses at a spacecraft and at the Earth (via an Earth orbiting satellite), a three dimensional position of the spacecraft can be determined. One day of data from a small onboard X-ray detector yields a three dimensional position accurate to approximately 150 km. This accuracy is independent of spacecraft distance from the Earth. Present techniques for determining the two spacecraft coordinates other than range measure angles and thus degrade with increasing spacecraft range. Thus navigation using X-ray pulsars will always be superior to present techniques in measuring these two coordinates for sufficiently distant spacecraft. At present, the break even point occurs near the orbit of Jupiter. The Crab pulsar can also be used to obtain one transverse coordinate with an accuracy of approximately 20 km. Author

N81-27130*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROPAGATION PATH LENGTH VARIATIONS DUE TO BENDING OF OPTICAL FIBERS **c74**
K. Y. Lau *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 28-32 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 20F

The geometric effect and material stress effects are included. Calculations are shown that put an upper limit on the expected phase shift in single mode fibers. The fractional change in propagation constant is presented. Moding effects in multimode

fibers cause extraneous phase shifts of unusually high magnitude. This does not occur in single mode fibers, rendering them very insensitive to bending with a theoretical limit given by the above relation. T.M.

N81-27131*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PERFORMANCE OF CONCATENATED CODES FOR DEEP SPACE MISSIONS c17
S. A. Butman, L. J. Deutsch, and R. L. Miller *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 33-39 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 09F

Computer simulation results are presented on the performance of convolutional codes of constraint lengths 7 and 10 concatenated with the (255, 223) Reed-Solomon code (a proposed NASA standard). These results indicate that as much as 0.8 dB can be gained by concatenating this Reed-Solomon code with a (10, 1/3) convolutional code, instead of the (7, 1/2) code currently used by the DSN. Author

N81-27132*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HIGH POWER SEMICONDUCTOR LASERS FOR DEEP SPACE COMMUNICATIONS c36
J. Katz *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 40-50 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 20E

The parameters of semiconductor lasers pertaining to their application as optical emitters are discussed. Several methods to overcome their basic disadvantage, which is the low level of powers they emit, are reviewed. Most of these methods are based on a coherent power combining of several lasers. T.M.

N81-27133*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CAPACITY OF A MULTIMODE DIRECT DETECTION OPTICAL COMMUNICATION CHANNEL c32
H. H. Tan (California Univ. at Irvine) *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 51-70 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

The capacity is derived under both peak and average signal power constraints and without a signal bandwidth constraint. A random telegraph wave type signalling scheme of Kabanov is known to achieve capacity provided enough signalling bandwidth is available. In the absence of received background noise, an optimally coded PPM system is shown to achieve capacity with greatly reduced bandwidth as compared to Kabanov signals. T.M.

N81-27134*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EFFECTS OF THE GASEOUS AND LIQUID WATER CONTENT OF THE ATMOSPHERE ON RANGE DELAY AND DOPPLER FREQUENCY c32
W. L. Flock *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 71-86 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

When high precision is required for range measurement on Earth space paths, it is necessary to correct as accurately as possible for excess range delays due to the dry air, water vapor, and liquid water content of the atmosphere. Calculations based on representative values of atmospheric parameters are useful for illustrating the order of magnitude of the expected delays. Range delay, time delay, and phase delay are simply and directly related. Doppler frequency variations or noise are proportional to the time rate of change of excess range delay. Tropospheric effects were examined as part of an overall consideration of the capability of precision two way ranging and Doppler systems. T.M.

N81-27135*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ATMOSPHERIC NOISE TEMPERATURE MEASUREMENTS c32
C. T. Stelzried *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 87-96 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

Radiometric microwave noise temperature measurements were used to estimate atmospheric transmission loss. The following lumped element model expression is used for the noise temperature contribution, T double prime = T sub p (1 - 1/L). This relationship is used to estimate the transmission loss L in terms of T double prime and the atmosphere effective physical temperature T sub p. This report evaluates T sub p in terms of assumed distributed loss and temperature models. Simplified expressions are presented for low loss applications. For these applications L was determined directly and accurately without integration or iteration. T.M.

N81-27136*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SECOND-GENERATION X/S FEEDCONE: CAPABILITIES LAYOUT, AND COMPONENTS c33
J. R. Withington *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 97-103 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

High power (20 kW) S and X band transmitting systems were added to the Second Generation Common Aperture X/S Feedcone System to demonstrate X and S band uplink/downlink capabilities. Design considerations of new X band components, cone layout, and capabilities are discussed. T.M.

N81-27137*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
IMPROVED COOLING DESIGN FOR HIGH POWER WAVEGUIDE SYSTEM c33
W. C. J. Chen and R. Hartop *In its* The Telecommun. and Data Acquistion Rept. 15 Jun. 1981 p 104-107 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

Testing of X band high power components in a traveling wave resonator indicates that this improved cooling design reduces temperature in the waveguide and flange. The waveguide power handling capability and power transmission reliability is increased substantially. T.M.

N81-27138*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AN EVALUATION OF THE INTEL 2920 DIGITAL SIGNAL PROCESSING INTEGRATED CIRCUIT c33
J. Heller *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 108-113 ref (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

The circuit consists of a digital to analog converter, accumulator, read write memory and UV erasable read only memory. The circuit can convert an analog signal to a digital representation, perform mathematical operations on the digital signal and subsequently convert the digital signal to an analog output. Development software tailored for programming the 2920 is presented. T.M.

N81-27139*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HIGH-POWER TRANSMITTER AUTOMATION, PART 2 c33
M. A. Gregg *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 114-117 ref (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

The current status of the transmitter automation development is reported. The work described is applicable to all transmitters in the Deep Space Network. New interface and software designs are described which improve reliability and reduce the time required for subsystem turn on and klystron saturation. T.M.

N81-27140*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A MULTIPLE ACCESS COMMUNICATION NETWORK BASED ON ADAPTIVE ARRAYS c32

S. Zohar *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 118-127 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

A single frequency communication system is considered consisting of K possibly moving users distributed in space simultaneously communicating with a central station equipped with a computationally adapted array of n = or > K antennas. Such a configuration could result if K spacecraft were to be simultaneously trackd by a single DSN complex consisting of an n antennas array. The array employs K sets of n weights to segregate the signals received from the K users. The weights are determined by direct computation based on known position information of the K users. Currently known techniques require (for n = K) about (4/3)K to the 4th power computer operations (multiply and add) to perform such computations. A technique that accomplishes this same goal in 8 K to the 3rd power operations, yielding a reduction by a factor K/6, was developed. T.M.

N81-27141*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE EFFECT OF NOISY CARRIER REFERENCE ON TELEMETRY WITH BASEBAND ARRAYING c17
D. Divsalar, D. Hansen, and J. H. Yuen *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 128-135 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 09F

Imperfect carrier reference causes a degradation in detection performance in coherent communication systems. A measure of this degradation is the radio loss, which is the amount of increase in data signal to noise ratio (SNR) per bit required to achieve the same bit error rate when carrier reference is perfect. Performance analysis and numerical results are obtained for the Voyager high rate telemetry link with maximum likelihood convolutional decoding. The arraying of antennas provides not only improved performance due to an increase in effective antenna aperture, but also a decrease in radio loss with respect to a single antenna. This telemetry link performance improvement is a function of the carrier loop SNR and data bit error rate. When the carrier loop SNR's are low, it provides a significant improvement in the telemetry link performance since the decrease in radio loss with respect to a single station is substantial. T.M.

N81-27142*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE EFFECTS OF POINTING ERRORS ON THE PERFORMANCE OF OPTICAL COMMUNICATIONS SYSTEMS c74
V. A. Vilnrotter *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 136-146 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 20F

Optical communications systems operating over interplanetary distances require the use of extremely narrow optical beams for maximum power concentration near the receiver. Consequently, pointing errors must be kept to a small fraction of a beamwidth to avoid severe deterioration in receiver performance, due to the decrease in received power associated with pointing errors. Mathematical moels required for studying the effects of random pointing errors were developed and applied to the problem of quantifying the effects of pointing errors on the performance of coherent and incoherent optical receivers. T.M.

N81-27143*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ON THE CORRECTION FOR QUANTIZATION EFFECTS IN SIGNAL-TO-NOISE RATIO ESTIMATION c17
L. Howard *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 147-149 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 09F

In sampled data digital telemetry systems the signal to noise ratio (SNR) is typically derived as a function of the moments of the digitized input stream (e.g., the receiver output). This analog to digital conversion process is itself an additional noise source known as the quantization noise. Thus a digitally measured SNR will only approximately represent the SNR of the analog input signal. A procedure (Sheppard's corrections) for correcting moments of any order for this quantization effect is presented. T.M.

N81-27144*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORKS CONSOLIDATION PROGRAM SYSTEM DESIGN c14
E. C. Gatz *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 150-153 ref (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

The general system design for the Mark 4-A Deep Space Network to be implemented in the Networks Consolidation Program is discussed. The arrangement and complement of antennas and the list of subsystem equipment at the Signal Processing Center are described. E.D.K.

N81-27145*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ASSESSMENT OF SOLAR-ASSISTED GAS-FIRED HEAT PUMP SYSTEMS c44
F. L. Lansing *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 154-190 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 10A

As a possible application for the Goldstone Energy Project, the performance of a 10 ton heat pump unit using a hybrid solar gas energy source was evaluated in an effort to optimize the solar collector size. The heat pump system is designed to provide all the cooling and/or heating requirements of a selected office building. The system performance is to be augmented in the heating mode by utilizing the waste heat from the power cycle. A simplified system analysis is described to assess and compute interrelationships of the engine, heat pump, and solar and building performance parameters, and to optimize the solar concentrator/building area ratio for a minimum total system cost. In addition, four alternative heating cooling systems, commonly used for building comfort, are described; their costs are compared, and are found to be less competitive with the gas solar heat pump system at the projected solar equipment costs. T.M.

N81-27146*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PERFORMANCE OF THE REAL-TIME ARRAY SIGNAL COMBINER DURING THE VOYAGER MISSION c17
C. D. Bartok *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 191-202 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 09F

During the Voyager Mission each Deep Space Station used its 64 meter antenna together with a 34 meter antenna to form an array. Data were selected from the Saturn encounter period from November 2 to November 13, 1980, to analyze the signal combiner performance. A statistical analysis of the residual gain data from all of the arrayed Deep Space Stations indicates that the Real Time Combiner is operating within the designed accuracy range of 0.2 + or - 0.05 dB around the theoretical gain. A decrease in the residual gain value appears to correlate with an increase in antenna elevation, which may be directly related to the changing antenna gain with elevation. Overall, the combined signal to noise ratio is improved by an average of 0.62 + or - 0.15 dB over the 64 meter signal to noise ratio alone. T.M.

N81-27147*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE OPERATIONAL PERFORMANCE OF HYDROGEN MASERS IN THE DEEP SPACE NETWORK (THE PERFORMANCE OF LABORATORY REFERENCE FREQUENCY STANDARDS IN AN OPERATIONAL ENVIRONMENT) c36
S. C. Ward *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 203-218 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 20E

Spacecraft navigation to the outer planets (Jupiter and beyond) places very stringent demands upon the performance of frequency and time (F&T) reference standards. The Deep Space

Network (DSN) makes use of hydrogen masers as an aid in meeting the routine F&T operational requirements within the 64 m antenna network. Results as of October 1980 indicate the hydrogen masers are performing within the required specifications. Two problem areas are discussed: insufficient control over the environment in which the reference standards reside; and frequency drift. T.M.

N81-27148*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ELECTRICAL LOAD MANAGEMENT AT THE GOLDSTONE DSN COMPLEX c33
J. C. Rayburn *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 219-225 (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

A Power Load Management Plan was deveoped which utilizes the unique power generating capabilities of the stations to reduce the stress on the local utility's reserve capacity and reduce the cost of electrical power at the stations. The plan has greatly reduced the cost of Goldstone electrical power by completely eliminating the use of commercial power during the local utility's high usage periods each day. T.M.

N81-27149*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PLANETARY RADAR c89
R. D. Shaffer, P. R. Wolken, and R. F. Jurgens *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 226 (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 03A

The radar astronomy activities supported by the Deep Space Network during the first quarter of 1981 are reported. The bodies observed include the asteroids Apollo and Toro, comet Bradfield, and the rings of Saturn. T.M.

N81-27150*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SURVEY OF THE US MATERIALS PROCESSING AND MANUFACTURING IN SPACE PROGRAM
E. C. McKannan Jul. 1981 71 p
(NASA-TM-82427) Avail: NTIS HC A04/MF A01 CSCL 22A

To promote potential commercial applications of low-g technology, the materials processing and manufacturing in space program is structured to: (1) analyze the scientific principles of gravitational effects on processes used in producing materials; (2) apply the research toward the technology used to control production process (on Earth or in space, as appropriate); and (3) establish the legal and managerial framework for commercial ventures. Presently federally funded NASA research is described as well as agreements for privately funded commercial activity, and a proposed academic participation process. The future scope of the program and related capabilities using ground based facilities, aircraft, sounding rockets, and space shuttles are discussed. Areas of interest described include crystal growth; solidification of metals and alloys; containerless processing; fluids and chemical processes (including biological separation processes); and processing extraterrestrial materials. A.R.H.

N81-27151# Committee on Science and Technology (U. S. House).
THE SPACE INDUSTRIALIZATION ACT OF 1980
Washington GPO 1980 92 p Hearings before the Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., No. 132, 11-12 Jun. 1980
(GPO-66-307) Avail: Subcommittee on Space Science and Applications

Issues of research and development and the role for the Federal Government in fostering and enhancing technological transfer and innovation while maintaining the integrity of the nation's free enterprise system are considered with emphasis on the proposal to establish a space industrialization corporation. This revised bill places greater emphasis on the corporation as a financing institution and specifically includes financing for space related services and related equipment and facilities. Financing would be available for space technology transfers (spinoffs) with applications for Corporation financing limited to U.S. citizens and businesses. NASA's role would be increased to assure establishment to economical space industrialization systems capabilities and to provide, on a reimbursable basis, assistance in operations and the furnishing of associated equipment and facilities, in addition to research and development and launch assistance. A.R.H.

N81-27152# Centre National d'Etudes Spatiales, Toulouse (France). Dept. Des Affaires Univ.
THERMAL CONTROL IN SPACEBORNE EXPERIMENTS [LE CONTROLE THERMIQUE DES EXPERIENCES SPATIALES]
1981 134 p refs In FRENCH Conference proceedings held at Toulouse, 12-16 Jan. 1981
(ISSN-0244-8041) Avail: NTIS HC A07/MF A01

Temperature control of spacecraft is addressed, with emphasis on calculation of radiative, conductive and convective heat transfer at the design level. Temperature dependent problems of spacecraft contamination were studied. Mathematical modeling and temperature calculations are extensively discussed. Techniques and equipment for thermal testing are also considered. For individual titles, see N81-27153 through N81-27162.

N81-27153# Centre National d'Etudes Spatiales, Toulouse (France).
GENERALITIES ON THERMAL CONTROL c18
A. Rolfo *In its* Thermal Control of Spaceborne Expts. 1981 p 1-3 In FRENCH (For primary document see N81-27152 18-12)
Avail: NTIS HC A07/MF A01

The role of the heat engineer in a spaceborne experiment project is discussed. Consideration of constraints peculiar to thermal control problems early on in the spacecraft design stage is emphasized. Special conditions encountered in space and their impact on operations are elucidated. A balance relation for satellite temperature in orbit is given. The need for thermal tests and predictions is also indicated. Author (ESA)

N81-27154# Centre National d'Etudes Spatiales, Toulouse (France).
RADIATION [LE RAYONNEMENT] c34
A. Rolfo *In its* Thermal Control of Spaceborne Expts. 1981 p 5-13 refs In FRENCH (For primary document see N81-27152 18-12)
Avail: NTIS HC A07/MF A01

Radiation in the wavelengths extending from 0.2 microns (ultraviolet) to 15 microns (infrared) was studied. The complexity of the calculation of radiative coupling in a satellite is stressed. A computation method, based on certain hypotheses and simplifications, makes possible calculation of this effect in a reasonable amount of time and with acceptable accuracy. Fundamental laws of thermal radiation are given, and applications to modeling radiative heat transfer between different bodies and in the case of real bodies are shown. Author (ESA)

N81-27155# Centre National d'Etudes Spatiales, Toulouse (France).
CONDUCTIVE AND CONVECTIVE TRANSFER [LES ECHANGES CONDUCTIFS ET CONVECTIFS] c34
M. C. Desjean *In its* Thermal Control of Spaceborne Expts. 1981 p 15-35 refs In FRENCH (For primary document see N81-27152 18-12)
Avail: NTIS HC A07/MF A01

The measure of difficulty encountered in the evaluation of conductive and convective heat transfer in a satellite, or in any space vehicle, was assessed. The need for realistic thermal simulation testing to assure confidence in calculation results is brought out. Conduction is defined according to kinetic theory, and a thermal model of satellite temperature is explained. Convection is then considered, especially as to heat transfer in a balloon-borne experiment. Both free convection and forced convection are covered. Results from various flow experiments are cited, and appropriate equations are presented. Author (ESA)

N81-27156# Centre National d'Etudes Spatiales, Toulouse (France).
CALCULATION OF EXTERNAL FLUX: SPACE ENVIRONMENT [CALCUL DES FLUX EXTERNES - ENVIRONNEMENT SPATIAL] c34
A. Rolfo and J. Mauduyt *In its* Thermal Control of Spaceborne

Expts. 1981 p 37-46 refs In FRENCH (For primary document see N81-27152 18-12)
Avail: NTIS HC A07/MF A01

The principal forms of energy absorbed by a satellite were studied relative to the calculation of its thermal behavior in orbit. Three external radiation sources are identified: direct solar flux; solar flux reflected by the Earth's atmosphere (albedo); and terrestrial infrared flux. Except in the case of solar flux, and then only if reflected solar flux absorption is discounted, the calculation of absorbed external flux was demonstrated as very complex. Practical approximation formulas are presented. Results show that terrestrial radiation and albedo have little influence on a satellite beyond 1200 to 1500 km in altitude. Below this limit, the effect of these heat sources on satellite temperature requires that calculation precision be adapted in consequence.
Author (ESA)

N81-27157# Centre National d'Etudes Spatiales, Toulouse (France).
OUTGASSING AND CONTAMINATION IN SPACE [DEGAZAGE ET CONTAMINATION DANS L'ESPACE] **c18**
J. Guillin *In its* Thermal Control of Spaceborne Expts. 1981 p 47-55 refs In FRENCH (For primary document see N81-27152 18-12)
Avail: NTIS HC A07/MF A01

The risk of spaceborne equipment degradation, exacerbated by contamination phemomena, was evaluated. Causes, contaminant transport mechanisms, and eventual effects are considered. A mathematical representation of gas emission events, modeling the sources and diffusion of contaminants, is presented. Analytic and experimental equipment which measures the potential and kinetics of outgassing materials as well as the optical influence and thermo-optics of deposits is described. Methods are suggested for reducing contamination, and the special problems of a manned spacecraft, e.g., Spacelab, are brought up. Author (ESA)

N81-27158# Centre National d'Etudes Spatiales, Toulouse (France).
TECHNOLOGIES USED IN THERMAL CONTROL OF SATELLITES, SONDES AND SPACEBORNE EXPERIMENTS [TECHNOLOGIES UTILISEES POUR LE CONTROLE THERMIQUE DES SATELLITES, DES SONDES ET DES EXPERIENCES EMBARQUEES] **c18**
I. Alet, J. C. Guillaumon, and B. Tatry *In its* Thermal Control of Spaceborne Expts. 1981 p 57-84 In FRENCH (For primary document see N81-27152 18-12)
Avail: NTIS HC A07/MF A01

An assortment of design solutions to temperature control problems encountered in an aerospace environment were reviewed. Spacecraft thermal control, using either thermo-optical coatings, insulators, heat conductors, or thermoregulation components, is considered. Fluid heat flow devices, radiators, hinged shielding, and applications of phase change materials are also discussed. Cooling techniques are enumerated and explained. Particular difficulties arising when furnaces are used in space are brought up. As an example of a complex temperature control system, the Spacelab thermal control circuit is shown.
Author (ESA)

N81-27159# Centre National d'Etudes Spatiales, Toulouse (France).
MATHEMATICAL MODELING AND TEMPERATURE CALCULATIONS [MODELISATION MATHEMATIQUE ET CALCULS THERMIQUES] **c18**
A. M. Pouzet *In its* Thermal Control of Spaceborne Expts. 1981 p 85-96 In FRENCH (For primary document see N81-27152 18-12)
Avail: NTIS HC A07/MF A01

The design procedure which is followed when building a mathematical model of spacecraft thermal conditions is traced. Calibration of the model by analysis of predictions on thermal simulation tests as well as model application in determining in-flight operating temperatures are then discussed. Configuration characteristics which must be known to construct the model are identified. A simplified representation of possible heat sources is combined with models of the geometrical and thermal environment. The analysis of thermal environment tests in view of model reliability assessment is explained. Author (ESA)

N81-27160# Centre National d'Etudes Spatiales, Toulouse (France).
COMPUTER PROGRAMS USED FOR TEMPERATURE CALCULATIONS [LOGICIELS UTILISES DANS LES CALCULS DE THERMIQUE] **c34**
J. F. Gory *In its* Thermal Control of Spaceborne Expts. 1981 p 97-108 refs In FRENCH (For primary document see N81-27152 18-12)
Avail: NTIS HC A07/MF A01

A program package which simulates satellite temperature, either in orbit or in a space environment simulator, is decomposed into its various modules and explained. The geometry of the external structure of the satellite is given as a simplified geometrical model. Only external heat sources are taken into account and their flux densities are supposed known. The object of the program is to determine the heat transfer between the different satellite parts. The radiative transfer coefficients are derived. A system of heat budget equations which give satellite temperature, either for a transient regime or for steady state is presented. Author (ESA)

N81-27161# Centre National d'Etudes Spatiales, Toulouse (France).
METHODS AND MEANS OF THERMAL TESTING [METHODES ET MOYENS D'ESSAIS THERMIQUES] **c14**
B. Tatry *In its* Thermal Control of Spaceborne Expts. 1981 p 109 In FRENCH (For primary document see N81-27152 18-12)
Avail: NTIS HC A07/MF A01

The principle and fundamental parameters of space environment simulation are discussed. Emphasis is placed on the quality of vacuum, heat sink characteristics, and solar flux aspect. Thermal test models must accurately represent the final spacecraft design as to dimensional and heat transfer qualities. Three space environment simulators are presented, accompanied by equipment data sheets. The use of simulator tests to quality mathematical models of spacecraft thermal behavior is stressed. Author (ESA)

N81-27162# Centre National d'Etudes Spatiales, Toulouse (France).
MEANS AVAILABLE AT THE CNES FOR MEASURING THERMO-OPTICAL CHARACTERISTICS [MOYENS DE MESURE DE CARACTERISTIQUES THERMO OPTIQUES DISPONIBLES AU CNES] **c34**
B. Tatry *In its* Thermal Control of Spaceborne Expts. 1981 p 117-128 In FRENCH (For primary document see N81-27152 18-12)
Avail: NTIS HC A07/MF A01

The analytic principles of measurement techniques currently in use for the evaluation of spacecraft operating temperature, are reviewed. The absolute measure of total hemispheric emissivity, the relative measure of infrared emissivity at ambient temperature, and the absolute measure of solar reflectance are covered. Respective measuring instruments are mentioned, and attainable accuracies are given. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N81-27163*# National Aeronautics and Space Administration, Washington, D. C.
SUBPROGRAMS FOR INTEGRATING THE EQUATIONS OF MOTION OF SATELLITES. FORTRAN 4
V. I. Prokhorenko Feb. 1980 68 p refs Transl. into ENGLISH "Podprogrammy Integrirovaniya uravneniy Dvizheniya Iskusstvennykh Sputnikov Zemli" Rept. Pr-302, Moscow, 1977 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Academy of Sciences, USSR
(NASA-TM-75702; Pr-302) Avail: NTIS HC A04/MF A01 CSCL 22D

The subprograms for the formation of the right members of the equations of motion of artificial Earth satellites (AES), integration of systems of differential equations by Adams' method, and the calculation of the values of various functions from the

AES parameters of motion are described. These subprograms are written in the FORTRAN 4 language and constitute an essential part of the package of applied programs for the calculation of navigational parameters AES. E.A.K.

N81-27164# European Space Agency, Paris (France).
REENTRY OF SKYLAB (ORBITAL COMPUTATION ASPECT)
J. P. Carrou, J. M. Robert, D. Vienne, F. Barlier, and R. Futaully Mar. 1981 134 p refs Transl. into ENGLISH of 'Rentree de SKYLAB (aspect orbitographie)', CNES, Toulouse Report CNES-CT/EMT/MT/MS/208, Jul. 1979
(ESA-TT-688; CNES-CT/EMT/MT/MS/208) Avail: NTIS HC A07/MF A01

The calculations undertaken as part of the French effort in the final tracking of Skylab are discussed. The radar and optical tracking system is described and the quality of measurements is assessed. The Skylab orbit during the last eight days before impact is analyzed. The atmospheric model used in making orbit predictions is shown and the reentry prediction is given in detail. Orbit determinations are used to identify the mean aerodynamic coefficient in function of height which represents the rate of orbit decay for the period. Results are shown as predictions of the Skylab ground tracks. Author (ESA)

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N81-27165*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
DEVELOPMENT OF A COMPOSITE GEODETIC STRUCTURE FOR SPACE CONSTRUCTION, PHASE 2 Final Report
30 Jul. 1981 104 p refs
(Contract NAS9-15678)
(NASA-CR-161017; MDC-G9390) Avail: NTIS HC A06/MF A01 CSCL 22B

Primary physical and mechanical properties were defined for pultruded hybrid HMS/E-glass P1700 rod material used for the fabrication of geodetic beams. Key properties established were used in the analysis, design, fabrication, instrumentation, and testing of a geodetic parameter cylinder and a lattice cone closeout joined to a short cylindrical geodetic beam segment. Requirements of structural techniques were accomplished. Analytical procedures were refined and extended to include the effect of rod dimensions for the helical and longitudinal members on local buckling, and the effect of different flexural and extensional moduli on general instability buckling. A.R.H.

N81-27166# European Space Agency, Paris (France).
REENTRY OF SKYLAB: OPERATIONAL ASPECTS
J. C. Caroff, J. Y. Trebaol, I. Legoff, and J. Sculfort Apr. 1981 201 p Transl. into ENGLISH of "Rentree de SKYLAB (Aspect - Operations)" CNES, Toulouse Report CNES-CT/EMT/OPS/0/079, Aug. 1979 Original report in FRENCH previously announced as N81-21100
(ESA-TT-692; CNES-CT/EMT/OPS/0/079) Avail: NTIS HC A10/MF A01

The French contribution to the final tracking of Skylab is described. Interagency collaboration within the French scientific community and French cooperation with NASA are detailed. Global tracking operations organization are also described, as well as the tracking equipment used. A rundown of significant events affecting operations support over the final 24 hr of Skylab orbital lifetime is presented. An eyewitness account (Skylab public release information No. 19) of the vehicle reentry and breakup is given. A chronological recapitulation of messages exchanged between the French space agency and NASA is also given. Author (ESA)

N81-27126*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE DSN TRACKING SYSTEM
J. A. Wackley *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 8-15 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

N81-27127*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PIONEERS 6 THROUGH 12 MISSION SUPPORT
R. Nevarez *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 16-17 (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

N81-27128*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VOYAGER MISSION SUPPORT
N. Fanelli and H. Nance *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 19-21 (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

N81-27144*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORKS CONSOLIDATION PROGRAM SYSTEM DESIGN
E. C. Gatz *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 150-153 ref (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

N81-27161# Centre National d'Etudes Spatiales, Toulouse (France).
METHODS AND MEANS OF THERMAL TESTING [METHODES ET MOYENS D'ESSAIS THERMIQUES]
B. Tatry *In its* Thermal Control of Spaceborne Expts. 1981 p 109 In FRENCH (For primary document see N81-27152 18-12)
Avail: NTIS HC A07/MF A01

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N81-27167* National Aeronautics and Space Administration, Washington, D. C.
DYNAMICS EXPLORER DUAL SPACECRAFT TO BE LAUNCHED ON JULY 31
16 Jul. 1981 23 p
(NASA-News-Release-81-95; P81-10096) Avail: NTIS Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22B

Plans for the launch of the Dynamics Explorers A and B are announced. The mission of the spacecraft is described. Specific knowledge about the coupling of energy, electric currents, electric fields, and plasmas between the magnetosphere, the ionosphere, and the atmosphere is sought. The instrumentation of the spacecraft is described and the spacecraft and Delta 3918 launch vehicle characterized. Detailed background information amplifying the mission is included. J.D.H.

N81-27168* National Aeronautics and Space Administration, Washington, D. C.
FIFTH FLTSATCOM TO BE LAUNCHED
16 Jul. 1981 9 p
(NASA-News-Release-81-93; P81-10094) Avail: NTIS Avail: NASA Scientific and Technical Information Facility, P.O. 8757, B.W.I. Airport, Md. 21240 CSCL 22B

Launch of the FLTSATOOM-E, into an elliptical orbit by the Atlas Centaur launch vehicle is announced. The launch and relevant

launch operations are described. A chart of the launch sequence for FLTSATCOM-E communication satellite is given. E.A.K.

N81-27169*# Systems Science and Software, La Jolla, Calif.
ANALYSIS OF THE CHARGING OF THE SCATHA (P78-2) SATELLITE Final Report, Mar. 1979 - Oct. 1980
P. R. Stannard, I. Katz, M. J. Mandell, J. J. Cassidy, D. E. Parks, M. Rotenberg, and P. G. Steen Dec. 1980 249 p refs Sponsored in cooperation with AFGL
(Contract NAS3-21762)
(NASA-CR-165348; SSS-R-81-4798) Avail: NTIS HC A11/MF A01 CSCL 22B

The charging of a large object in polar Earth orbit was investigated in order to obtain a preliminary indication of the response of the shuttle orbiter to such an environment. Two NASCAP (NASA Charging Analyzer Program) models of SCATHA (Satellite Charging at High Altitudes) were used in simulations of charging events. The properties of the satellite's constituent materials were compiled and representations of the experimentally observed plasma spectra were constructed. Actual charging events, as well as those using test environments, were simulated. Numerical models for the simulation of particle emitters and detectors were used to analyze the operation of these devices onboard SCATHA. The effect of highly charged surface regions on the charging conductivity within a photosheath was used to interpret results from the onboard electric field experiment. Shadowing calculations were carried out for the satellite and a table of effective illuminated areas was compiled. J.D.H.

N81-27170# Centre National d'Etudes Spatiales, Toulouse (France). Service ARGOS.
DATA COLLECTION AND LOCATION BY SATELLITE
1979 107 p Conference held at Lanham, Maryland, 13-14 Sep. 1979
Avail: NTIS HC A06/MF A01

User applications and salient features of the Tiros-N/ ARGOS data collection system are reviewed. Topics touch on technical data concerning orbits, data acquisition, and platform location. Also discussed are data processing and distribution of results. Data collection platform which employ ARGOS are described. Data acquisitions are used for ice reporting, meteorological balloon location, and for monitoring conditions aboard a twin-hull canoe, traversing the Pacific, along with its location. Numerous first GARP Global Experiment ARGOS system uses are mentioned as well. For individual titles, see N81-27171 through N81-27181.

N81-27171# Centre National d'Etudes Spatiales, Toulouse (France). Service ARGOS.
THE ARGOS SYSTEM: TECHNICAL DATA CONCERNING ORBITS, DATA ACQUISITION AND PLATFORM LOCATION
A. Goasguen *In its* Data Collection and Location by Satellite 1919 16 p (For primary document see N81-27170 18-15)
Avail: NTIS HC A06/MF A01

The operational characteristics of the ARGOS system onboard the Tiros-N and NOAA-A satellites are described. Satellite orbital parameters are listed. Data acquisition is discussed as the elementary probability of message acquisition and as a function of transmitted message density. Application to data collection platforms, monitoring system performance and bit error rate are considered. Platform location is also explained, including the principle, location statistics, number of location calculations per day and location accuracy. Operational test results are shown as curves. Author (ESA)

N81-27172# Centre National d'Etudes Spatiales, Toulouse (France). Service ARGOS.
THE ARGOS SYSTEM: DATA PROCESSING, AVAILABILITY AND DISTRIBUTION OF RESULTS
J. L. Bessis *In its* Data Collection and Location by Satellite 1979 p 14 (For primary document see N81-27170 18-15)
Avail: NTIS HC A06/MF A01

The ARGOS data processing system utilizing Tiros N satellites is described in an operational configuration. The system configuration, data file preparation, preprocessing, sensor data processing, and location processing are discussed. The data collection to availability intervals for the operational data collection and platform location system are then assessed. Results to date are 65% of data available in < 4 hr, 85% in < 6 hr, and 98% in < 10 hr. An improvement in availability is foreseen. The data distribution service, the global telecommunication system, and links via switched networks are also specified. Author (ESA)

N81-27173# Centre National d'Etudes Spatiales, Toulouse (France). Service ARGOS.
THE ARGOS SYSTEM: SITUATION AND PROGRESS TO DATE
M. Taillade *In its* Data Collection and Location by Satellite 1979 p 9 (For primary document see N81-27170 18-15)
Avail: NTIS HC A06/MF A01

The use of the ARGOS system and mid-term prospects are discussed. Potential users' response to promotion of the location and data collection capabilities of the system is analyzed. The progression and distribution of users' interest by country of all correspondants on all subjects and at all levels from 1976 to 1 Aug. 1979 are reported. System utilization is discussed. Actual operations are tabulated and broken down by platform type. It is noted that the first GARP Global Experiment accounts for 58% of total use. Author (ESA)

N81-27174# Coast Guard, Washington, D.C. Oceanographic Unit.
OPERATIONAL USE OF TIROS/ARGOS SYSTEM IN INTERNATIONAL ICE PATROL
J. J. Murray and C. R. Weir *In* CNES Data Collection and Location by Satellite 1979 11 p (For primary document see N81-27170 18-15)
Avail: NTIS HC A06/MF A01

The feasibility of using satellite trackable transmitters on buoys in order to measure the Labrador Current and the North Atlantic Current off the coast of Newfoundland was studied. Results would be used for warning mariners of the hazards presented by drifting ice and icebergs. The local user terminal is described and the handling of satellite tracked buoy data is depicted. Results show that a more sophisticated computer model which predicts iceberg drift can be implemented using satellite information. Author (ESA)

N81-27175# National Oceanic and Atmospheric Administration, Bay St. Louis, Miss.
U.S. DRIFTING BUOY PERFORMANCE DURING FGGE
E. G. Kerut and R. P. Kozak *In* CNES Data Collection and Location by Satellite 1979 13 p (For primary document see N81-27170 18-15)
Avail: NTIS HC A06/MF A01

As part of the U.S. drifting buoy development program extensive testing was performed to verify system performance prior to the start of the experiment. End to end systems tests were performed to establish system interface compatibility and to determine correction to production buoys that were needed prior to buoy deployment during the experiment. Data quality analyses were performed on systems prior to and during buoy deployment periods. Sixty-four buoys were deployed by ship and aircraft in the southern oceans as part of an array of over 300 meteorological drifting buoys participating in the experiment. Preliminary results indicate that approximately 50% of the buoys are still operational after one year of operation. An extensive test and evaluation program preceded the deployment of operational buoys. Predeployment and deployment testing was performed to evaluate the quality of the data from each of the buoys being deployed. A description of each test and the evaluation results are given. Buoy performance during the first and second Special Observing Periods is summarized. Author (ESA)

N81-27176# National Center for Atmospheric Research, Boulder, Colo.
UTILIZATION OF THE TIROS-N ARGOS SYSTEM FOR THE TROPICAL CONSTANT LEVEL BALLOON EXPERIMENT
Paul R. Julian and Ernest W. Lichfield *In* CNES Data Collection and Location by Satellite 1979 6 p Sponsored by NSF (For primary document see N81-27170 18-15)
Avail: NTIS HC A06/MF A01

The Tropical Constant Level Balloon System was designed to provide a global wind data set (direction and velocity) for the tropics for use in atmospheric research. Balloon launch strategy

and launch system performance are described. On the average, data and locations were obtained for each balloon four times per day by the ARGOS system. The consistency of locations and wind velocities is very good. Even with limited data it is possible to construct a wind map that gives a picture of the tropical circulation that cannot be derived in any other way.
Author (ESA)

N81-27177# Toba Merchant Marine Coll. (Japan). Dept. of Oceanography.
THE TRANSPACIFIC EXPERIMENT SAILING BY YASEI-GO 3
Hiroaki Ochiai, Haruki Kadokawa (Society of Ancient Pacific Cultures), Kazunobu Fujimoto (Society of Ancient Pacific Cultures), Muneyuki Matsui (Society of Ancient Pacific Cultures), and Shoji Takeuchi *In* CNES Data Collection and Location by Satellite 1979 6 p (For primary document see N81-27170 18-15)
Avail: NTIS HC A06/MF A01

Plans for a transpacific experimental sailing as well as for the use of the ARGOS system are described. The hypothesis that Japanese drifted on the Black Current, then on the North Pacific Current in canoes as far as the Ecuadorian coast and as long ago as 3000 B.C. is presented. The canoe design, based on archeological data, is depicted. Although the Yasei-go 3 mission is primarily anthropological, meteorological data collection and location at sea are carried out by the ARGOS system. The data set can be used to demonstrate the effectiveness of the ARGOS data collection system. Author (ESA)

N81-27178# Naval Oceanographic Office, Bay St. Louis, Miss.
PRELIMINARY RESULTS OF GULF STREAM RING TRACKING VIA SATELLITE-TRACKED DRIFTERS
Barry P. Blumenthal *In* CNES Data Collection and Location by Satellite 1979 11 p Submitted for publication (For primary document see N81-27170 18-15)
Avail: NTIS HC A06/MF A01

The most promising technique to monitor several rings simultaneously at reasonable cost is to tag each ring with a satellite tracked, freedrifting buoy. The initial investigation began in the fall of 1978 and utilized five air deployable buoys. The buoys transmitted to the NIMBUS-6 satellite Random Access Measurement System and the position of the buoy was calculated from the Doppler shifted signal. Two buoys were launched in September and one in November 1978. One drifter remained trapped in its ring for 110 days before drifting out into the Sargasso Sea. A second ring was tracked for 39 days before it coalesced with the Gulf Stream which swept the buoy eastward. The third drifter left its ring in 15 days after completing a large 150 km loop around the ring perimeter. The remaining two buoys were deployed in March 1979. One buoy was tracked for only one month at which time the frequency of the transmitted signals drifted outside the allowable limits. The last buoy, which is still transmitting, provided real time tracking of the ring through June when Navy laboratories conducted Gulf Stream ring acoustics experiments. Author (ESA)

N81-27179# Centre National d'Etudes Spatiales, Toulouse (France).
ARGOS DATA DISTRIBUTION SYSTEMS (ADDS)
G. Sans *In its* Data Collection and Location by Satellite 1979 5 p (For primary document see N81-27170 18-15)
Avail: NTIS HC A06/MF A01

The distribution to the users of the data collected by ARGOS is explained. Access is either in near real time by direct consultation or through the Global Telecommunications System network for weather experiments. The ARGOS central computing and communications facility is described in order to give future users a better understanding of the system and how to use it. The communications facility operational status is detailed and procedures for reaching the data base station and getting back results are outlined. Author (ESA)

N81-27180# Avions Marcel Dassault, Saint-Cloud (France). Electronique Marcel Dassault.
PRESENTATION OF ELECTRONIQUE MARCEL DASSAULT AND ARGOS PLATFORMS
Jeanjean *In* CNES Data Collection and Location by Satellite 1979 11 p (For primary document see N81-27170 18-15)
Avail: NTIS HC A06/MF A01

The company, Electronique Marcel Dassault, and its space activites are described. The development and implementation of the ARGOS platforms is highlighted. These operational versions of the experiment/data collection system interface and platform transmitter terminal are discussed: the buoy platform; the ship or ground station platform; and the ballon platform. The electronics along with the electronics package are depicted. Results obtained during the special observation period for ARGOS system utilization confirm the reliability of this equipment. Author (ESA)

N81-27181# Centre National d'Etudes Spatiales, Toulouse (France).
TIROS-N/ARGOS: CANADIAN EXPERIENCE
B. C. Wiebe *In its* Data Collection and Location by Satellite 1979 3 p (For primary document see N81-27170 18-15)
Avail: NTIS HC A06/MF/ A01

Five Canadian programs which involve the use of satellites in the communication of data from remote sites are reviewed from an industrial viewpoint. The advantages offered by the Tiros-N/ARGOS data collection system are examined. Data acquisition interfaces include: (1) six automatic weather stations which monitor meteorological parameters in the Beaufort Sea area; (2) a thirty-six drogued drifter buoy configuration in the Baffin Bay and the Lancaster Sound; (3) a meteorological buoy in the northeast Pacific located at 50 deg N, 145 deg W; (4) remote water survey monitors in the McKenzie Delta area of the Northwest Territories and in the eastern Ontario area; and (5) First GARP Global Experiment drifter buoys deployed around the world. Author (ESA)

N81-27182# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
NUCLEAR-POWERED SATELLITE STUDIES Final Report, 1 Oct. 1978 - 31 Mar. 1980
M. H. Kaplan Mar. 1981 41 p refs
(Contract DE-AS02-76ET-33013)
(DOE/ET-33013/1) Avail: NTIS HC A03/MF A01

Discussions of several aspects are included: e.g., schedule, personnel, and technology developments. The reporting period represents the final 18 months of activities of a project which was designed to provide continuing support in the area of nuclear space power technology. Results were obtained and communicated to the scientific community via publications and presentations. Project personnel participated in point design efforts, a NASA Space Power Committee, and periodically provided support to Department of Energy activities as the need arose. This final report is intended to summarize activities over the life of the project. DOE

N81-27183# Sandia Labs., Albuquerque, N. Mex.
OPTICAL/ANALYTICAL METHOD FOR DETERMINING THE SPACE-TIME TRAJECTORY OF A FREE-FLIGHT ROCKET
Thomas F. Stueber Dec. 1980 25 p
(Contract DE-AC04-76DP-00789)
(SAND-81-0273) Avail: NTIS HC A02/MF A01

The trajectory of a free flight rocket can be determined by optical means in cases where radars or lasers cannot track effectively. The optical method described uses fixed position motion picture cameras along the nominal flight line to provide three dimensional space and time coordinates. The method was used for a test series whose data is included with detailed sample calculations for each step of the algorithm. DOE

N81-27184# Institut fuer Physikalische Weltraumforshung, Freiburg (West Germany).
STUDY OF THE INTERFACE BETWEEN SCIENTIFIC EXPERIMENTS AND TELEMETRY SYSTEMS ON BOARD SOUNDING ROCKETS AND SATELLITES WITH THE AIM TO STANDARDIZE THE INTERFACE Final Report
Wolfgang Ott and Helmut Wolf Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 102 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-36; ISSN-0170-1339) Avail: NTIS HC A06/MF A01

A standardized design for experiment/telemetry encoder interface electronics was sought. Facility in the integration of

different output signals from measurement instruments onboard sounding rockets or spacecraft with existent pulse code modulation telemetry systems is required. Signal outputs are characterized, including analog, digital, and mixed analog with digital signals as well as digital serial signals and digital parallel signals. A microprocessor unit which is compatible with these various signal types is proposed which provides a standard interface; cost of experiment integration with data acquisition ground support systems is reduced, while system checkout is also simplified.
Author (ESA)

N81-27185# Centre d'Etudes et de Recherches en Technologie Spatiale, Toulouse (France). Dept. Automatique.
PRELIMINARY STUDY OF DIGITAL ATTITUDE CONTROL DESIGN TECHNIQUES FOR SATELLITES
J. P. Chretien, P. Rodrigo, M. Gauvrit, D. Bontoux, and J. Jodeau Paris ESA Apr. 1979 265 p refs
(Contract ESTEC-3372/77-NL-AK(SC))
(CERT-1/7171-DERA; ESA-CR(P)-1406) Avail: NTIS HC A12/MF A01

A frequency adaptive control technique is verified, i.e., a conservative double integrator coupled to one resonant mode. Reference loops with continuous control networks are described. Methods for deriving a digital controller, using information derived from existing analog control systems, are also described.
Author (ESA)

N81-27186# Engins Matra, Velizy (France).
CALCULATION OF THE LOW PRESSURE AEROTHERMAL TRANSFER COEFFICIENT: APPLICATION TO STRATOSPHERIC MISSILE TRAJECTORIES [CALCUL DE COEFFICIENT D'ECHANGE AEROTHERMIQUE A BASSE PRESSION APPLICATION AUX TRAJECTOIRES STRATOSPHERIQUES DE MISSILES]
M. Bellin 10 Dec. 1979 6 p refs In FRENCH
(N-FIT-760) Avail: NTIS HC A02/MF A01

The heat transfer coefficient introduced into analogical heating equations in the form of a flux quotient of dimensions is determined from the relation between three groups of dimensionless variables characterizing the thermomechanical properties of the fluid, the flow, and the specific heat transfer characteristics. A maximum discrepancy of 20% exists between the calculated and experimentally obtained results. At low pressures the velocity of the gas in contact with the wall can no longer be considered null. An elastic collision spherical molecule model is employed. This model can be applied up to an altitude of 60,000 m. Beyond this altitude other models and solar radiation effects must be considered. It is concluded that neither low pressures nor ionization phenomena need be taken into account. Author (ESA)

N81-27187# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Regelungssysteme.
STANHP: A PROGRAM FOR THE STATISTICAL ANALYSIS OF GUIDANCE LOOPS FOR HOMING MISSILE SYSTEMS
Rainer Froriep and Hans-Dieter Joos Jun. 1980 72 p refs In GERMAN; ENGLISH summary
(DFVLR-MITT-80-17) Avail: NTIS HC A04/MF A01

The behavior of missile systems is simulated with mathematical models. A FORTRAN program (STANHP) which requires little computational time for the analysis of active and semiactive homing missile systems is presented. The most important statistical moments, expectation and standard deviation for all desired quantities are calculated directly and as functions of time. The mathematical modeling, the formulation and solving of the moment equations, the program structure and some integration routines are explained. Author (ESA)

N81-27188# Eurosat S.A., Geneva (Switzerland).
INVENTORY FOR ERS-1 END USERS Final Report
C. L. P. Miller Paris ESA Feb. 1981 139 p
(Contract ESA-4480/80-FHS(SC))
(ESA-CR(P)-1417) Avail: NTIS HC A07/MF A01

A marketing study of potential users of a remote sensing maritime satellite was performed. The present status of and future prospects for fishing, shipping, offshore oil and gas, coastal management and pollution monitoring activities are described. Potential services include ship routing, storm warning, sea state reporting, and maritime insurance data (sea state prior to an accident). Potential European users are found to expect free or low cost services. It is further revealed that serious thought and study will have to be given to the question of how an operational set up will be financed, operated and organized for commercial and economic applications. Author (ESA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N81-27189*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex. Systems Engineering Dept.
STS-2: SAIL NON-AVIONICS SUBSYSTEMS MATH MODEL REQUIREMENTS
W. P. Bennett and R. W. Herold Nov. 1980 420 p refs Supersedes LEMSCO-14524
(Contract NAS9-15800)
(NASA-CR-160957; JSC-16748-A; LEMSCO-14524-A; LEMSCO-14524) Avail: NTIS HC A18/MF A01 CSCL 22B

Simulation of the STS-2 Shuttle nonavionics subsystems in the shuttle avionics integration laboratory (SAIL) is necessary for verification of the integrated shuttle avionics system. The math model (simulation) requirements for each of the nonavionics subsystems that interfaces with the Shuttle avionics system is documented and a single source document for controlling approved changes (by the SAIL change control panel) to the math models is provided. R.C.T.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N81-27125*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MARK 4-A DSCC TELEMETRY SYSTEM DESCRIPTION
R. Burt *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 3-7 ref (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 09F

N81-27129*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NAVIGATION USING X-RAY PULSERS
T. J. Chester and S. A. Butman *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 22-25 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 22A

N81-27131*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PERFORMANCE OF CONCATENATED CODES FOR DEEP SPACE MISSIONS
S. A. Butman, L. J. Deutsch, and R. L. Miller *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 33-39 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 09F

N81-27141*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE EFFECT OF NOISY CARRIER REFERENCE ON TELEMETRY WITH BASEBAND ARRAYING
D. Divsalar, D. Hansen, and J. H. Yuen *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 128-135 refs

(For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 09F

N81-27143*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ON THE CORRECTION FOR QUANTIZATION EFFECTS IN SIGNAL-TO-NOISE RATIO ESTIMATION
L. Howard *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 147-149 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 09F

N81-27146*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PERFORMANCE OF THE REAL-TIME ARRAY SIGNAL COMBINER DURING THE VOYAGER MISSION
C. D. Bartok *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 191-202 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 09F

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N81-27190*# Martin Marietta Corp., Denver, Colo.
AN APPROXIMATE SOLUTION TO IMPROVE COMPUTATIONAL EFFICIENCY OF IMPEDANCE-TYPE PAYLOAD LOAD PREDICTION
Charles W. White Jul. 1981 206 p refs
(Contract NAS1-14370)
(NASA-CR-165719; MRC-80-654) Avail: NTIS HC A10/MF A01 CSCL 22B

The computational efficiency of the impedance type loads prediction method was studied. Three goals were addressed: devise a method to make the impedance method operate more efficiently in the computer; assess the accuracy and convenience of the method for determining the effect of design changes; and investigate the use of the method to identify design changes for reduction of payload loads. The method is suitable for calculation of dynamic response in either the frequency or time domain. It is concluded that: the choice of an orthogonal coordinate system will allow the impedance method to operate more efficiently in the computer; the approximate mode impedance technique is adequate for determining the effect of design changes, and is applicable for both statically determinate and statically indeterminate payload attachments; and beneficial design changes to reduce payload loads can be identified by the combined application of impedance techniques and energy distribution review techniques. E.A.K.

N81-27153# Centre National d'Etudes Spatiales, Toulouse (France).
GENERALITIES ON THERMAL CONTROL
A. Rolfo *In its* Thermal Control of Spaceborne Expts. 1981 p 1-3 In FRENCH (For primary document see N81-27152 18-12)
Avail: NTIS HC A07/MF A01

N81-27157# Centre National d'Etudes Spatiales, Toulouse (France).
OUTGASSING AND CONTAMINATION IN SPACE [DEGAZAGE ET CONTAMINATION DANS L'ESPACE]
J. Guillin *In its* Thermal Control of Spaceborne Expts. 1981 p 47-55 refs In FRENCH (For primary document see N81-27152 18-12)
Avail: NTIS HC A07/MF A01

N81-27158# Centre National d'Etudes Spatiales, Toulouse (France).
TECHNOLOGIES USED IN THERMAL CONTROL OF SATELLITES, SONDES AND SPACEBORNE EXPERIMENTS [TECHNOLOGIES UTILISEES POUR LE CONTROLE THERMIQUE DES SATELLITES, DES SONDES ET DES EXPERIENCES EMBARQUEES]
I. Alet, J. C. Guillaumon, and B. Tatry *In its* Thermal Control of Spaceborne Expts. 1981 p 57-84 In FRENCH (For primary document see N81-27152 18-12)
Avail: NTIS HC A07/MF A01

N81-27159# Centre National d'Etudes Spatiales, Toulouse (France).
MATHEMATICAL MODELING AND TEMPERATURE CALCULATIONS [MODELISATION MATHEMATIQUE ET CALCULS THERMIQUES]
A. M. Pouzet *In its* Thermal Control of Spaceborne Expts. 1981 p 85-96 In FRENCH (For primary document see N81-27152 18-12)
Avail: NTIS HC A07/MF A01

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N81-27191*# National Academy of Sciences - National Research Council, Washington, D. C. Aeronautics and Space Engineering Board.
LIQUID ROCKET PROPULSION TECHNOLOGY: AN EVALUATION OF NASA'S PROGRAM
1981 63 p refs
(Contract NASw-3455)
(NASA-CR-164550) Avail: NTIS HC A04/MF A01 CSCL 21H

The liquid rocket propulsion technology needs to support anticipated future space vehicles were examined including any special action needs to be taken to assure that an industrial base in substained. Propulsion system requirements of Earth-to-orbit vehicles, orbital transfer vehicles, and planetary missions were evaluated. Areas of the fundamental technology program undertaking these needs discussed include: pumps and pump drives; combustion heat transfer; nozzle aerodynamics; low gravity cryogenic fluid management; and component and system life reliability, and maintenance. The primary conclusion is that continued development of the shuttle main engine system to achieve design performance and life should be the highest priority in the rocket engine program. E.A.K.

N81-27192*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LOX/GOX RELATED FAILURES DURING SPACE SHUTTLE MAIN ENGINE DEVELOPMENT
C. E. Cataldo May 1981 80 p
(NASA-TM-82424) Avail: NTIS HC A05/MF A01 CSCL 21H

Specific rocket engine hardware and test facility system failures are described which were caused by high pressure liquid and/or gaseous oxygen reactions. The failures were encountered

during the development and testing of the space shuttle main engine. Failure mechanisms are discussed as well as corrective actions taken to prevent or reduce the potential of future failures. A.R.H.

N81-27193*# Eagle Engineering, Inc., Houston, Tex.
MPD THRUSTER APPLICATION STUDY
Jan. 1981 38 p refs
(Contract JPL-955842)
(NASA-CR-165481; JPL-9950-563) Avail: NTIS HC A03/MF A01 CSCL 21C

Developmental considerations for the magneto-plasma-dynamic (MPD) thruster are defined. General characteristics of an MPD engine are compared to those of chemical propulsion and ion bombardment engines and performance criteria which are mission specific are examined. Requirements for thruster ground testing facilities are discussed and the utilization of the space shuttle for an orbital flight test is addressed. M.G.

N81-27194*# National Aeronautics and Space Administration, Washington, D. C.
SPACE PROPULSION SYSTEMS. PRESENT PERFORMANCE LIMITS AND APPLICATION AND DEVELOPMENT TRENDS
Rolf D. Buehler and Roger E. Lo May 1981 87 p Transl. into ENGLISH of Paper 78-102 presented at the German Aerodyn. and Space Flight Congr. (West Germany), 1978 p 1-52 Conf. held in Darmstadt, West Germany, 19-23 Sep. 1978 Original language document was announced as A79-14063 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76163; Rept-78-102) Avail: NTIS HC A05/MF A01 CSCL 21H

Typical spaceflight programs and their propulsion requirements as a comparison for possible propulsion systems are summarized. Chemical propulsion systems, solar, nuclear, or even laser propelled rockets with electrical or direct thermal fuel acceleration, nonrockets with air breathing devices and solar cells are considered. The chemical launch vehicles have similar technical characteristics and transportation costs. A possible improvement of payload by using air breathing lower stages is discussed. The electrical energy supply installations which give performance limits of electrical propulsion and the electrostatic ion propulsion systems are described. The developmenst possibilities of thermal, magnetic, and electrostatic rocket engines and the state of development of the nuclear thermal rocket and propulsion concepts are addressed. E.A.K.

N81-27195*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
STRUCTURAL ANALYSIS OF CYLINDRICAL THRUST CHAMBERS, VOLUME 2 Final Report
W. H. Armstrong Mar. 1981 60 p refs 3 Vol.
(Contract NAS3-21953)
(NASA-CR-165241; LMSC-HREC-TR-D698400-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 21H

Analytical results are presented which predict cumulative plastic deformation characteristic of damage observed in coolant channel walls of regeneratively cooled rocket thrust chambers. The damage consists of bulging and plastic flow which leads to thinout and rupture of the channel wall under the combined effects of high pressures, high temperatures and temperature gradients experienced during cyclic firings of actual test chambers. Analytical predictions correlate with test results. Author

N81-27196*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
STRUCTURAL ANALYSIS OF CYLINDRICAL THRUST CHAMBERS, VOLUME 3 Final Report
M. L. Pearson Mar. 1981 95 p refs 3 Vol.
(Contract NAS3-21953)
(NASA-CR-165242; LMSC-HREC-TR-D698440-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 21H

A system of three computer programs is described for use in conjunction with the BOPAGE finite element program. The programs are demonstrated by analyzing cumulative plastic deformation in a regeneratively cooled rocket thrust chamber. The codes provide the capability to predict geometric and material nonlinear behavior of cyclically loaded structures without performing a cycle-by-cycle analysis over the life of the structure. The program set consists of a BOPACE restart tape reader routine, and extrapolation program and a plot package. Author

N81-27197# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
HARDWARE EVALUATION OF A SPACECRAFT ac POWER DISTRIBUTION SYSTEM Final Report
J. Schrade Paris ESA Jul. 1980 83 p
(Contract ESTEC-3021/NL-HP)
(ESA-CR(P)-1410) Avail: NTIS HC A05/MF A01

Components of the system were built and tested based on payloads containing tansistor power amplifiers (TPA) and traveling wave tubes (TWT). A dc/ac square wave inverter supplying two TPA power supplies, an electronic power conditioner for a 150 W TWT, and a dc/ac inverter with a capability of 130 W supplying a ac/dc converter having 40 W at four outputs, were constructed. Design features are given along with mass data and circuit diagrams. Efficiency and load characteristics are shown for all components. Using test results and estimates for relevant dc/dc hardware, an attempt was made to establish whether ac power distribution is superior for spacecraft. When a large number of converters are involved, preference is shown for ac systems, whereas for few powerful payloads, dc distribution offers clear advantages. Author (ESA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

No abstracts in this category.

24 COMPOSITE MATERIALS

Includes laminates.

N81-27198*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ION SPUTTER TEXTURED GRAPHITE Patent Application
James S. Sovey, Ralph Forman, Arthur N. Curren, and Edwin G. Wintucky, inventors (to NASA) Filed 15 May 1981 14 p
(NASA-Case-LEW-12919-1; US-Patent-Appl-SN-264378) Avail: NTIS HC A02/MF A01 CSCL 11D

A specially textured surface of pyrolytic graphite which exhibits extremely low yields of secondary electrons and reduced numbers of reflected primary electrons after impingement of high energy primary electrons is described. An ion flux having an energy between 500 eV and 1000 eV and a current density between 1.0 mA/sq cm and 6.0 mA/sq cm produces surface roughening or texturing which is in the form of needles or spires. Such textured surfaces are especially useful as anode collector plates in high efficiency electron tube devices. NASA

N81-27199*# National Aeronautics and Space Administration, Washington, D. C.
HOT ISOSTATIC PRESSING OF SILICON NITRIDE SiSUB3N4 CONTAINING ZIRCON, OR ZIRCONIA AND SILICA
S. Somiya, M. Yoshimura, T. Suzuki, and H. Nishimura Dec. 1980 16 p refs Transl. into ENGLISH from Taikabutsu (Japan), 1979 p 258, 332-339 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75880) Avail: NTIS HC A02/MF A01 CSCL 11D

A hydrothermal synthesis apparatus with a 10 KB cylinder was used to obtain a sintered body of silicon nitride. The sintering auxiliary agents used were zircon ($ZrSiO_4$) and a mixture of zirconia (ZrO_2) and silica (SiO_2). Experiments were conducted

with the amounts of ZrSi04 or ArO2 and SiO2 varying over a wide range and the results compared to discover the quantity of additive which produced sintering in silicon nitride by the hot pressing method. E.D.K.

N81-27200*# Clemson Univ., S.C.
OPTIMIZATION OF FIBER REINFORCED STRUCTURES TO SATISFY AEROELASTIC REQUIREMENTS Final Technical Report
Carl S. Rudisill [1981] 8 p ref
(Grant NsG-1411)
(NASA-CR-164536) Avail: NTIS HC A02/MF A01 CSCL 11D

A numerical procedure was developed for minimizing the structural mass of an aircraft structure which must have a specified minimum flutter velocity or divergence velocity. During the optimization process the arrangement of the structural members remains fixed, while the stiffness parameters of the structure are varied. Author

N81-27201*# United Technologies Research Center, East Hartford, Conn.
IMIDE MODIFIED EPOXY MATRIX RESINS Final Report
D. A. Scola and R. H. Pater 1 Feb. 1981 97 p refs
(Contract NAS3-22032)
(NASA-CR-165229; R80-914770-12) Avail: NTIS HC A05/MF A01 CSCL 11D

High char yield epoxy using novel bisimide amines (BIA's) as curing agents with a state of the art epoxy resin was developed. Stoichiometric quantities of the epoxy resin and the BIA's were studied to determine the cure cycle required for preparation of resin specimens. The bisimide cured epoxies were designated IME's (imide modified epoxy). The physical, thermal and mechanical properties of these novel resins were determined. The levels of moisture absorption exhibited by the bisimide amine cured expoxies (IME's) were considerably lower than the state of the art epoxies. The strain-to-failure of the control resin system was improved 25% by replacement of DDS with 6F-DDS. Each BIA containing resin exhibited twice the char yield of the control resin MY 720/DDS. Graphite fiber reinforced control (C) and IME resins were fabricated and characterized. Two of the composite systems showed superior properties compared to the other Celion 6000/IME composite systems and state of the art graphite epoxy systems. The two systems exhibited excellent wet shear and flexural strengths and moduli at 300 and 350 F. E.A.K.

N81-27202*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
APPROXIMATE ANALYSIS OF POSTBUCKLED THROUGH-WIDTH DELAMINATIONS
John D. Whitcomb Jun. 1981 31 p refs
(NASA-TM-83147) Avail: NTIS HC A03/MF A01 CSCL 11D

An approximate analysis was developed to analyze the postbuckling behavior of through-width delaminations in a laminated coupon. The analysis contains two parameters which are determined using a finite element analysis. After calculating the parameters for a few configurations, the approximate analysis was used to analyze many other configurations. Lateral deflections and mode I strain-energy release rates obtained with the approximate analysis were compared with results from the finite element analysis. For the configurations analyzed, the approximate analysis agreed very well with the finite element results. Author

N81-27203# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
TENSILE FATIGUE PERFORMANCE OF GLASS FIBER DOMINATED COMPOSITES
J. F. Mandell, D. D. Huang, and F. J. McGarry Nov. 1980 29 p refs Sponsored in part by B. F. Goodrich Co., Lord Corp., and Dow Chemical Co.
(MIT-RR-R80-4) Avail: NTIS HC A03/MF A01

The fatigue S-N curves of a variety of glass fiber composites ranging from injection molded thermoplastics and SMC to unidirectional laminates are shown to have the same fatigue degradation, rate, losing approximately 10% of their initial tensile strength per decade of fatigue cycles. This degradation rate is found to derive from the reinforcement: unimpregnated strands have the same fatigue performance as do composites. The matrix and interface contribute nothing to fatigue resistance. The underlying mechanisms responsible for this behavior are discussed. Exceptions are shown to occur in some materials due to specimen effects, and in others due to more severe degradation mechanisms with woven fabric reinforcement. Author

N81-27204*# National Aeronautics and Space Administration, Washington, D. C.
HIGH PRESSURE GAS STORAGE CAPACITIES. EXAMPLE OF A SOLUTION USING FILAMENT WINDINGS
A. Phan and J. Lamalle Feb. 1981 22 p refs Transl. into ENGLISH of "Capacites pour Stockage de Gaz a Haute Pression. Exemples de solution utilisant le bobinage filamentaire" Soc. Natl. Indus. Aerospatiale, Paris, 1979 p 1-19 Presented at Journees du Verre Textile et des Plastiques Renforces Conf., 1978 Translation was announced as N80-28728 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75904) Avail: NTIS HC A02/MF A01 CSCL 11D

The use of epoxy resin fiber glass and economic factors affecting the choice of materials for gas storage are discussed. The physical nature of the filament windings are described together with the results obtained. It is demonstrated that a substantial reduction in mass and an enhanced level of safety can be assured at a competitive cost by storing gases in this way. E.A.K.

N81-27205*# SRI International Corp., Menlo Park, Calif. Engineering Sciences Lab.
CARBON FIBER MODIFICATION Final Report, 23 Oct. 1978 - 1 Aug. 1979
Thomas E. Thompson 9 Nov. 1979 22 p refs
(Contract NAS2-10091; SRI Proj. 7976)
(NASA-CR-166201) Avail: NTIS HC A02/MF A01 CSCL 11D

The effect of several chemical treatments on the electrical and mechanical properties of carbon fibers was investigated with an optimum goal of increasing the electrical resistivity by a factor of 1000 without appreciably changing the mechanical properties. It was possible to effect resistivity increases from 10 to 50 percent without adversely affecting the tensile strength or Young's modulus for T-300 and C-6000 PAN fibers by treatments with either AlCl3 or nitric acid mixtures. Larger increases in the resistivity were produced with pitch fibers treated with nitric acid mixtures. This treatment also produced a partial decomposition of the pitch fiber and deterioration of the mechanical properties. The rationale behind the approch was to immobilize the conductivity producing pi electrons in the microscopic aromatic structure of the carbon fibers without destroying the strength producing sigma bonds. The investigations indicate that certain chemical treatments can produce such results, but the total reduction in the electrical conductivity which was achieved was not large enough to impact on problems which might arise from the high conductivities of the fibers. E.D.K.

N81-27206# Aeronautical Research Labs., Melbourne (Australia).
ANALYSIS OF COMPOSITE LAMINATES AND FIBER COMPOSITE REPAIR SCHEMES
R. Jones Oct. 1980 17 p refs
(AD-A099629; ARL/STRUC-NOTE-465; AR-002-236) Avail: NTIS HC A02/MF A01 CSCL 11/4

In recent years several advanced finite element methods have been developed for the analysis of laminated composites; these take into account the membrane, bending, and interlaminar stresses. Similarly, finite element methods have also been developed for the analysis of structures repaired with a bonded overlay of fiber composite material. The present paper discusses these methods and indicates how the finite element method developed for the analysis of structural repairs is connected to those methods specifically developed for the analysis of composite laminates. Author (GRA)

N81-27207# California Univ., Livermore. Lawrence Livermore Lab.
AGING AND QUALITY ASSURANCE OF KEVLAR 49-EPOXY COMPOSITES

Roger J. Morgan 15 May 1981 34 p refs
(Contract W-7405-eng-48)
(UCID-19026) Avail: NTIS HC A03/MF A01

The aging of Kevlar 49 epoxy composites under the service environment conditions expected by ESA will be insignificant to the best of our knowledge at this time. However, certain precautions in materials acceptance criteria and composite fabrication should be followed. DOE

N81-27208# Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany). Unternehmensbereich.

DEVELOPMENT OF A CFC WINDOW FRAME, USING SHORT FIBER PRESSING TECHNOLOGY Final Report

Frank Heinze and Gerhard Stemmer Bonn Bundesministerium fuer Forschung und Technologie Dec. 1980 123 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-80-032; ISSN-0170-1339) Avail: NTIS HC A06/MF A01

The development of a carbon fiber composite (CFC) cabin window frame is discussed and a series of full scale tests, including mechanical endurance tests, thermal studies, and environmental tests, are described. Its installation into a fuselage test panel (airbus structure) is described. The problems which were encountered are listed. The results show that the use of CFC in primary structures is technically feasible. Endurance tests to date include 32,000 flights without any failures. Preliminary work for continuing service trials in an aircraft is mentioned.Author (ESA)

N81-27209# European Space Agency, Paris (France).

STUDY OF THE FIBER MATRIX INTERFACIAL STRUCTURE AND OF THE INTERFACIAL DIFFUSION PHENOMENA IN COTAC-TYPE SOLIDIFICATION COMPOSITES: EFFECT ON THE THERMAL STABILITY OF THE FIBERS Thesis

Elvire Maroni Apr. 1981 145 p refs Transl. into ENGLISH of "Etude de la structure des interfaces fibre-matrice et des phenomenes de diffusion interfaciale dans les composites de solidification de type Cotac; consequence sur la stabilite thermique des fibres" ONERA Paris Report ONERA-NT-1979-11 Original report in FRENCH previously announced as N80-31489
(ESA-TT-661; ONERA-NT-1979-11) Avail: NTIS HC A07/MF A01

The fiber matrix interfacial structure of Cotac type composites was determined by electron microscopy. Interfaces were characterized using the diffusion technique. High resolution autoradiographs showed that diffusion as predominant along the fiber matrix interface. The diffusion coefficients of nickel and niobium were measured for Cotac 74 and Ni, Cr-TaC composites in order to obtain the diffusion data required to predict the high temperature stability of Cotac type composites. The high values of the activation energies for the interfacial diffusion of both nickel and niobium resulted from the interaction of the diffusing species with carbon. The structural stability of Cotac type composites was investigated at elevated temperatures. It was estimated from the experimental data that no degradation due either to isothermal Ostwald ripening or to thermal gradient coarsening should occur in service at high temperatures.
Author (ESA)

N81-27210# Research Inst. of National Defence, Stockholm (Sweden).

KEVLAR 49 FIBER COMPOSITES IN SANDWICH FACINGS

Fritz Larsson Feb. 1981 30 p
(FOA-C-20396-F9) Avail: NTIS HC A03/MF A01

Mechanical properties of honeycomb panels with cocured Kevlar 49 fiber reinforced facings were studied and compared with results from panels with E and S glass reinforced facings. The high specific stiffness of Kevlar composites were reflected in an initial panel bending stiffness which was superior to that of panels with E or S glass fiber reinforced facings if facing weight is considered. On the same base, facing load per unit width of Kevlar reinforced facings at flexure failure of panels was nearly comparable with that of E glass reinforced facings. Kevlar fiber toughness was demonstrated in facing fracture surfaces. Author (ESA)

N81-27211# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

RESIDUAL STRENGTH AND FATIGUE INVESTIGATION ON ARAMID-CARBON/EPOXY LAMINATES

W. G. J. Thart Apr. 1980 20 p refs Original contains color illustrations
(Contract NIVR-1824)
(NLR-TR-80039-U) Avail: NTIS HC A02/MF A01

Hybrid type laminates consisting of a carbon/epoxy core and face sheets of aramid fabric were investigated to determine the effect of aramid fabric on toughness. Residual strength tests were performed on laminate specimens with a central hole. The effect of temperature on residual strength was studied (measurements at room temperature and 338 K). Constant amplitude fatigue tests were carried out to investigate the effect of fatigue loading at low stresses on residual strength and to determine S-N curves for notched and unnotched material. The results demonstrate that aramid face sheets do not improve the residual strength or carbon/epoxy laminates. No consistent changes in residual strength were observed at 338 K. Fatigue loading can improve the residual strength of notched specimens.
Author (ESA)

N81-27212# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

MATERIALS RESEARCH IN THE SEA. AN INVESTIGATION INTO THE INFLUENCE OF ENVIRONMENTAL EXPOSURE ON MECHANICAL PROPERTIES OF GLASS FIBER REINFORCED COMPOSITES

W. H. M. vanDreumel Jan. 1980 15 p refs
(VTH-LR-291) Avail: NTIS HC A02/MF A01

Glass fiber reinforced polyester and epoxy resin filament wound cylinders with an internal radius of 100 mm, a wall thickness of 2 mm and a length of 600 mm were exposed to sea air, wet-dry conditions at the tide line, or immersed in the sea at 50 and 100 m, from 2 to 4 years. The winding patterns applied were circumferential for epoxy as well as polyester specimens and + or - 70 deg relative to the cylinder axis, as an optimized angle for epoxy specimens with respect to internal hydrostatic pressure. Shear stiffness and shear strength were determined with a torsion test. The 70 deg wound cylinders were loaded with an increasing internal hydrostatic pressure until failure occured. Fiber content and wall thickness were measured. Glass fiber reinforced epoxy shows no relevant degradation after exposure. Polyester resin specimens exposed to sea water are severely eroded. Test data are given in tables. Author (ESA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N81-27213 City Univ. of New York, N. Y.

LASER INDUCED CHEMICAL FLUORESCENE STUDIES Ph.D. Thesis

Barry H. Kohn 1981 72 p
Avail: Univ. Microfilms Order No. 8112743

The activation and deactivation rate constants for deuterated methyl fluoride and methyl chloride were determined. For CD3F activation of the v1, v4 state occurs with a rate constant of 680/msec torr; for CD3Cl the v1 state is populated with a rate constant of 490/msec torr and the v3 state, 52/msec torr. Self deactivation of CD3F occurs with a rate constant of 0.44/msec torr while for CD3Cl this process exhibits double exponential behavior resolving to 52/msec torr and 2.8/msec torr. The data is discussed in light of existing theoretical models. Dissert. Abstr.

N81-27214 British Library Lending Div., Boston Spa (England).

MULTIPLE CORRELATIONS OF RETENTION INDEXES

G. Dahlmann, H. J. K. Koeser, and H. H. Oelert Feb. 1981

18 p refs Transl. into ENGLISH from Chromatographia (West Germany), v. 12, no. 10, 1979 p 665-667
(BLL-RTS-12323) Avail: British Library Lending Div., Boston Spa, England

A method based on linear multiple correlation is introduced allowing the calculation of gas chromatographic retention indices from a set of column constants and three to four physical properties of the solute. The error is less than 2 percent. The formulation was tested for isothermal and temperature programmed working conditions. M.G.

N81-27215 British Library Lending Div., Boston Spa (England).
APPLICATION OF DIFFERENTIAL THERMAL ANALYSIS TO INVESTIGATION OF THE REACTION KINETICS OF SODIUM SUPEROXIDE DECOMPOSITION AND INVESTIGATION OF THE PHASE CHANGES IN A SODIUM SUPEROXIDE-CARBON DIOXIDE, WATER SYSTEM
B. Stojanovic Apr. 1981 24 p refs Transl. into ENGLISH from Nauchn. - Technicki Pregled (USSR), v. 27, no. 9, 1977 p 9-16
(BLL-RTS-12547) Avail: British Library Lending Div., Boston Spa, England

Kinetic calculations for the thermal decomposition reaction of sodium superoxide by differential thermal analysis are discussed. Values for energy activation E and formal kinetic reaction order n are calculated by Kissinger's kinetic expression method. Differential thermal analysis is applied to investigate phase changes during reaction in sodium superoxide/carbon dioxide, water system. It is shown that through phase changes during reaction a relative index of reaction progression can be obtained. E.A.K.

N81-27216 British Library Lending Div., Boston Spa (England).
PHOTO-OXIDATION OF POLY VINYL ALCOHOL (KINETIC EVALUATION FOR CARBONYL FORMATION)
H. Aoki, M. Uehara, and T. Suzuki Jan. 1981 10 p refs Transl. into ENGLISH from Zairyo (Japan), v. 27, no. 303, 1978 p 1141-1145
(BLL-RTS-11996) Avail: British Library Lending Div., Boston Spa, England

The formation of four types of carbonic compound during polyvinyl alcohol (PVA) photooxidation was kinetically analyzed. Infrared absorbtion was used as the diagnostic method. Photooxidation of high polymers under ultraviolet radiation often causes rupture of the polymer chain. It was found that the various carbonyl compounds formed in the course of the reaction stimulate polymer photooxidation. However, decomposition reaction during PVA photooxidation produces four kinds of carbonyl compounds: aldehydic, ketonic, acidic, and esteric. Correlations were established between total carbonyls formed and average molecule size and electrical changes. E.A.K.

N81-27217 British Library Lending Div., Boston Spa (England).
THE ELECTROPLATING OF POLYPROPYLENE: THEORETICAL ASPECTS AND PRACTICAL EXPERIENCES
H. P. Sasse Jan. 1981 18 p refs Transl. into ENGLISH from Galvanotechnik (West Germany), v. 69, no. 12, 1978 p 1067-1075
(BLL-RTS-11956) Avail: British Library Lending Div., Boston Spa, England

Automatic currentless chemical electroplating of injection molded polypropylene parts is described. The formulation, injection molding of polypropylene, fillers used, and the properties of polypropylene are discussed. The effects of injection time, temperature, pressure and tool temperature on adhesion are considered. Variations in adhesion behavior of ABS resins and filled and unfilled polypropylene are discussed. Temperatures of the mold and the mass were varied and the casting removed. Techniques of mounting the molded part prior to electroplating are discussed. Pretreatment conditions are tabulated: pickling, pre-activation, activation and acceleration are discussed. Chemical electroplating with nickel is described. Adhesion and thermal cycling tests of the electroplated parts are described. ABS resins can be electroplated in the same plant. J.D.H.

N81-27218 British Library Lending Div., Boston Spa (England). Article Translating Service.
EFFECT OF ADSORPTION AND THE ELECTRODE FIELD ON THE DISSOCIATION CONSTANT OF A WEAK ACID NEAR THE ELECTRODE
S. G. Majranowskij Oct. 1980 24 p refs Transl. into ENGLISH from Kinet. Procesov Elektrodonych Mat. Symp. (USSR), 1978 p 87-97
(BLL-RTS-12423) Avail: British Library Lending Div., Boston Spa, England

An indirect method of calculating the dissociation constants in the layer near the electrode is presented. An analysis of the method of calculating the dissociation constants of weak acids adsorbed at the electrode is included. E.D.K.

N81-27219 British Library Lending Div., Boston Spa (England).
HYDROLYSIS OF HIGHER ALKYL SULPHURIC ACIDS
A. P. Melnik Jan. 1981 7 p refs Transl. into ENGLISH from Nefteperabotka i Neftekhimiya Tsniteneftekhim (USSR), no. 1, 1979 p 53-54
(BLL-RTS-12236) Avail: British Library Lending Div., Boston Spa, England

The effects of temperature, concentration, and the medium on the hydrolysis of dodecyl and hexadecyl sulphuric acids were investigated. The experimental results and the calculated values of the times of half conversion of the alkyl sulphuric acids show that they are reasonably stable compounds and they may be used as surface active agents in the form of solutions at low and moderate temperatures and also in acidic media with the addition of alcohols. E.D.K.

N81-27220*# National Aeronautics and Space Administration, Washington, D. C.
STUDIES ON CHEMICAL EVOLUTION USING CARBON SUBOXIDE
Hiroshi Yanagawa and Fujio Egami Jul. 1980 7 p refs Transl. into ENGLISH of Proceedings of the 11th Lunar and Planetary Symp. (Japan), Jul. 1978 p 259-261 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76590) Avail: NTIS HC A02/MF A01 CSCL 07D

It was learned that when carbon suboxide polymers react with hydroxylamine in modified sea water the amino acids glycine and lysine are produced and that they react with urea to produce nucleic acid-like substances. These results lead to the supposition that it is possible that carbon suboxide polymers may have accumulated in the primeval sea some three or more billion years ago and were transformed into the procursors of living molecules. E.D.K.

N81-27221*# National Aeronautics and Space Administration, Washington, D. C.
PROCESS FOR PURIFICATION OF SILICON
Heinz-Joerg Rath, Erhard Sirtl, and Waldemar Pfeiffer Feb. 1981 11 p refs Transl. into ENGLISH from German Patent no. 2722783, application date 20 May 1977, 30 Nov. 1978 p 1-7 Transl. into ENGLISH by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Wacker-Chemitronic Co. for Basic Electronic Materials, Inc.
(Contract NASw-3198)
(NASA-TM-76557) Avail: NTIS HC A02/MF A01 CSCL 07D

The purification of metallurgically pure silicon having a silicon content of more than 95% by weight is accomplished by leaching with an acidic solution which substantially does not attack silicon. A mechanical treatment leading to continuous particle size reduction of the granulated silicon to be purified is combined with the chemical purification step. E.D.K.

N81-27222*# National Aeronautics and Space Administration, Washington, D. C.
TRANSPORT FUNCTIONS OF NITROGEN UP TO 26,000 K
W. Hermann and E. Schade Jul. 1980 25 p refs Transl. into ENGLISH from Z. fuer Physik. (West Germany), v. 233, no. 4, 1970 p 333-350 Presented at Convention of Experts' Committee for Gas Discharge and Plasma Phys., Stuttgart, 1968 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Technische Hochschule, Munich
(Contract NASw-3198)

(NASA-TM-75837) Avail: NTIS HC A02/MF A01 CSCL 07D

The current field strength characteristic, E(1), and a large number of radial temperature distributions, T(r,I), measured in a 5 mm N2 cascade arc at normal pressure are used to evaluate the transport properties of nitrogen up to 26,000 K. The electrical conductivity sigma (T) and the Coulomb cross section are determined directly from the E(I) and several T(r,I) curves. Between 10,000 and 15,000 K the radiative energy flux for different arc current, the thermal conductivity, and from this the charge exchange cross section are determined in a good approximation utilizing the large number of measured temperature distributions. It turns out, that at the highest measured arc current, i.e., 570 A, in the axial region of the arc about 95% of the supplied energy is carried off by radiation. M.G.

N81-27223*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

CHEMICAL KINETIC ANALYSIS OF HYDROGEN-AIR IGNITION AND REACTION TIMES

R. Clayton Rogers and Charles J. Schexnayder, Jr. Jul. 1981 54 p refs

(NASA-TP-1856; L-14379) Avail: NTIS HC A04/MF A01 CSCL 07D

An anaytical study of hydrogen air kinetics was performed. Calculations were made over a range of pressure from 0.2 to 4.0 atm, temperatures from 850 to 2000 K, and mixture equivalence ratios from 0.2 to 2j0. The finite rate chemistry model included 60 reactions in 20 species of the H2-02-N2 system. The calculations also included an assessment of how small amounts of the chemicals H2O, NOx, H2O2, and O3 in the initial mixture affect ignition and reaction times, and how the variation of the third body efficiency of H2O relative of N2 in certaiin key reactions may affect reaction time. The results indicate that for mixture equivalence ratios between 0.5 and 1.7, ignition times are nearly constant; however, the presence of H2O and NO can have significant effects on ignition times, depending on the mixture temperature. Reaction time is dominantly influenced by pressure but is nearly independent of initial temperature, equivalence ratio, and the addition of chemicals. Effects of kinetics on reaction at supersonic combustor conditions are discussed. Author

N81-27224# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.

ORGANOMETALLIC PHOTOCHEMISTRY AT THE SOLID/GAS INTERFACE. PHOTOCHEMISTRY OF SURFACE-CONFINED COBALT TETRACARBONYL MONITORED BY FOURIER TRANSFORM INFRARED PHOTOACOUSTIC SPECTROSCOPY Interim Report

John B. Kinney, Ralph H. Staley, Carol L. Reichel, and Mark S. Wrighton 11 May 1981 21 p refs Submitted for publication

(Contract N00014-75-C-0880)

(AD-A099891; TR-26-ONR) Avail: NTIS HC A02/MF A01 CSCL 07/4

The photochemistry of surface-confined Co(CO)4 fragments exposed to reactive gases is reported. Such photochemistry is of importance in establishing primary events following excitation of the molecular entity attached to the surface and is of relevance to the photoactivation of surface-confined catalysts. The technique of Fourier transform infrared photoacoustic spectroscopy (FTIR/PAS) is used to monitor the photoreactions of a species on the surface including in situ monitoring of reactions involving a gas phase species. Without any sample manipulation or preparation, this technique has allowed characterization of the photochemistry of surface species with the molecular level specificity generally possible when infrared absorption spectroscopy is used to monitor reactions of metal carbonyls in homogeneous solution. The results establish FTIR/PAS as a technique of unequalled capability in monitoring such surface chemistry. E.D.K.

N81-27225# National Bureau of Standards, Washington, D.C. Surface Science Div.

SURFACE BINDING OF AN ELECTRONIC ANALOG TO CO: INFRARED EVIDENCE FOR CH3NC CHEMISORPTION ON Rh/AL2O3

R. R. Cavanagh and J. T. Yates, Jr. May 1981 34 p refs Submitted for publication

(Contract N00014-81-F-0008)

(AD-A099971; TR-23) Avail: NTIS HC A03/MF A01 CSCL 07/3

The chemisorption of methyl isocyanide by Al2O3-supported Rh has been investigated using transmission infrared spectroscopy. Evidence for the absence of dissociation or isomerization upon chemisorption is presented. The identification of various surface binding sites is possible and is in agreement with the site distribution previously demonstrated for such samples using CO with methyl isocyanide. Samples which are exposed to methyl isocyanide following saturation coverage with CO exhibit a 100/cm decrease in the C-triple bond-O stretching mode due to the presence of the isocyanide. This shift is interpreted in terms of a sigma donar-pi* acceptor interaction between the isocyanide and CO adsorbates. Author (GRA)

N81-27226# National Bureau of Standards, Washington, D.C. Surface Science Div.

SEARCH FOR CHEMISORBED HCO: THE INTERACTION OF FORMALDEHYDE, GLYOXAL AND ATOMIC HYDROGEN PLUS CO WITH Rh

J. T. Yates, Jr. and R. R. Cavanagh May 1981 34 p refs Submitted for publication

(Contract N00014-81-F-0008)

(AD-A099970; TR-22) Avail: NTIS HC A03/MF A01 CSCL 07/3

Transmission infrared spectroscopy has been used to search for the chemisorptive-stabilization of formyl (HCO) on Al2O3-supported Rh surfaces. Formaldehyde (H2CO) and glyoxal (HCO)2 have been used as potential sources of HCO. In addition, chemisorbed CO on Rh has been treated with atomic deuterium in an attempt to produce DCO. None of these routes have led to spectroscopically detectable levels of formyl adsorption at temperatures near or above 100 K. These results suggest that the formyl intermediate may not be a stable surface species on Rh in CO-hydrogenation chemistry. Author (GRA)

N81-27227# Northwestern Univ., Evanston, Ill. Dept. of Chemistry.

SYNTHESIS AND CHARACTERIZATION OF OCTAALKYL METALLO AND METAL-FREE PHTHALOCYANINES AND DECAALKYL URANYL SUPERPHTHALOCYANINES Interim Technical Report

Edward A. Cuellar and Tobin J. Marks 13 May 1981 32 p refs Submitted for publication

(Contract N00014-77-C-0231; Grants NSF CHE-76-84494; NSF CHE-80-09060; NR Proj. 053-640)

(AD-A099529; TR-16) Avail: NTIS HC A03/MF A01 CSCL 07/4

A straightforward, efficient, and generalizable synthesis of symmetrically substituted 2,3,9,10,16,17,23,24-octaalkyl phthalocyanines and 2,3,9,10,16,17,23,24,30,31-decaalkyl uranyl superphthalocyanines from o-dialkyl benzenes is described. For phthalocyanines, the approach is illustrated for methyl and n-butyl substituents, and both metal-free and nickel complexes are reported. Uranyl superphthalocyanines have been prepared with methyl and n-butyl substituents. The new complexes have been characterized by a variety of chemical and physicochemical methods. Quantitative determination of the solubilities of substituted and unsubstituted phthalocyanine and superphthalocyanine complexes in both 1,2,4-trichlorobenzene and toluene demonstrates decreasing solubility in the order (4,5-Bu2) 5SPcUO2 = (4-Me)5SPcUO2 = (4,5-Me2)5SPcUO2 - SPcUO2 = (4-Me)4PcH2 = Ni(4,5-Bu2)Pc = Ni(4,5-Me2) 4Pc - NiPc. Attempts to displace the uranyl ion from (4,5-R2)5SPcUO2 with acids or Cu(OAc)2 lead to the formation of (4,5-R2)4PcH2 or Cu(4,5-R2)4Pc, respectively. Author (GRA)

N81-27228# Northwestern Univ., Evanston, Ill. Dept. of Chemistry.

THE IMAGE FIELD EFFECT: HOW IMPORTANT IS IT?

George C. Schatz May 1981 18 p refs Submitted for publication

(Contract N00014-79-C-0794)

(AD-A099606) Avail: NTIS HC A02/MF A01 CSCL 07/4

This paper reviews the current status of the image field

effect model of Surface Enhanced Raman Spectroscopy (SERS), including the comparison between theoretical predictions and experimental results, and attempts to improve the image model through the use of wavevector dependent dielectric constants, finite size dipoles and a continuous variation of the electron density at the interface. Author (GRA)

N81-27229# Northwestern Univ., Evanston, Ill. Dept. of Chemistry.
A MEASUREMENT OF VIBRATIONAL EXCITATION IN NO PRODUCED IN THE PHOTODISSOCIATION OF NOCl AND NOBr AT 193 nm
Mark D. Moser and Eric Weitz May 1981 28 p refs Submitted for publication
(Contract N00014-79-C-0794)
(AD-A099635; TR-3) Avail: NTIS HC A03/MF A01 CSCL 07/4

Infrared emission has been observed from the vibrational state nu sub n (n equals 1 to = 16) of the nascent NO (X(2)pi) photofragment produced in the photodissociation of NOCl and NOBr at 193 nm. The photodissociation was observed to be a single photon process. Models and mechanisms of photodissociation are discussed in view of experimental observations. Author (GRA)

N81-27230# Ballistic Research Labs., Aberdeen Proving Ground, Md.
TRANSPORT ALGORITHMS FOR PREMIXED, LAMINAR STEADY STATE FLAMES
T. P. Coffee and J. M. Heimerl Mar. 1981 158 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A099735; AD-E430605; ARBRL-TR-02302) Avail: NTIS HC A08/MF A01 CSCL 21/2

The effects of different methods of approximating multispecies transport phenomena in models of premixed, laminar, steady-state flames have been studied. Five approximation methods that span a wide range of computational complexity are developed. Identical data for individual species properties have been used for each method. Each approximation method is employed in the numerical solution of a set of five H2-O2-N2 flames. For each flame the computed species and temperature profiles, as well as the computed flame speeds are found to be very nearly independent of the approximation method used. This does not indicate that transport phenomena are unimportant, but rather that the selection of the input values for the individual species transport properties is more important than the selection of the method used to approximate the multispecies transport. Based on these results, we have developed a sixth approximation method that is computationally efficient and which provides results extremely close to the most sophisticated and precise methods used. GRA

N81-27231# Army Military Personnel Center, Alexandria, Va.
THE ANODIC STRIPPING VOLTAMMETRIC ANALYSIS OF CHROMIUM USING THE HANGING MERCURY DROP ELECTRODE M.S. Thesis - Univ. of Western Kentucky. Final Report
John Edward Fugate 23 Apr. 1981 77 p refs
(AD-A100010) Avail: NTIS HC A05/MF A01 CSCL 07/2

The Hanging Mercury Drop Electrode (HMDE) is used in the anodic stripping analysis of ppm concentrations of chromium. The effects of such parameters as ionic strength, polymeric film formation, and the use of the chromate-sodium acetate standard are interpreted in terms of the electrochemical and physical properties of chromium in the +3 and +6 oxidation states. Author (GRA)

N81-27232# California Univ., Santa Barbara. Quantum Inst.
TUNNELING SPECTROSCOPY FOR THE STUDY OF ADSORPTION AND REACTION ON MODEL CATALYSTS
R. M. Kroeker (IBM Research Lab., San Jose, Calif.) and P. K. Hansma 27 May 1981 80 p refs Submitted for publication
(Contract N00014-78-C-0011; NR Proj. 056-673)
(AD-A099640; TR-8) Avail: NTIS HC A05/MF A01 CSCL 07/4

Inelastic Tunneling Spectroscopy has been used to study model catalyst systems. Model systems include oxidized alumina as a model for gamma-alumina and oxidized magnesium as a model for magnesia. Evaporated metals serve as models for supported metal catalysts. Detailed studies include CO adsorption and hydrogenation on rhodium, sulfur poisoning and the effect of top metal electrodes on the spectra. Author (GRA)

N81-27233# Chicago Univ., Ill. Dept. of Chemistry.
ION-ION NEUTRALIZATION PROCESSES AND THEIR CONSEQUENCES Final Report, 1 Jun. 1980 - 28 Feb. 1981
R. Stephen Berry 11 May 1981 5 p
(Contract DAAG29-80-K-0016)
(AD-A099905; ARO-16945.1-C) Avail: NTIS HC A02/MF A01 CSCL 07/4

This report summarizes the status of studies of the kinetics of dissociation and chemical relaxation of alkali halides in shock-heated vapors, and of the light emission processes that occur in such systems. These include light amplification in the wings of atomic lines of sodium and rubidium. GRA

N81-27234# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
DEFLAGRATION AND DETONATION FOR SMALL HEAT RELEASE
D. S. Stewart and G. S. S. Ludford Aug. 1980 26 p refs
(Contract DAAG29-79-C-0121)
(AD-A099911; TR-121; ARO-15882.24-M) Avail: NTIS HC A03/MF A01 CSCL 21/2

Technical Reports 117 and 118 develop the solutions (using activation-energy asymptotics) of one-dimensional steady combustion waves, deflagrations and detonations respectively, when the Mach number is not small. Even with the great simplifications afforded by the limit of large activation-energy some numerical calculations are necessary. However a completely analytical description of these solutions is possible whenever the heat released during reaction is small. In this paper, we give these explicit analytical solutions for the fast deflagration wave and a simple expression for its speed of propagation. As the speed of propagation approaches the lower Chapman-Jouget wave speed (slightly less than sonic velocity) we show that the velocity structure in front of the flame adjusts to a classical Taylor shock. We also give an explicit analytical solution for detonations traveling at speeds greater than the upper chapman-Jouget velocity (slightly greater than sonic velocity); in particular, such strong detonations are characterized by Taylor-like velocity adjustments both in front of and behind the flame. (For detonations the speed is not determined.) This work serves as the basis for a completely analytical treatment of the transition form deflagration to detonation. GRA

N81-27235# Indiana Univ. at Bloomington. Dept. of Chemistry.
CHEMICAL REACTIONS OF METAL-METAL BONDED COMPOUNDS OF THE TRANSITION ELEMENTS
Malcolm H. Chisholm and Ian P. Rothwell 18 May 1981 128 p refs Submitted for publication
(Contract N0014-76-C-0826; NR Proj. 056-625)
(AD-A099756; TR-81-3) Avail: NTIS HC A07/MF A01 CSCL 07/2

An overview of the reactivity patterns associated with compounds containing metal-to-metal bonds is presented. These reactions include formation, cleavage, photolysis, homolysis oxidative-addition, reductive-elimination, substitution and catalytic sequences. Author (GRA)

N81-27236# Yale Univ., New Haven, Conn. Temperature Chemical Reaction Engineering Lab.
AERODYNAMIC LEVITATION REACTOR STUDIES OF FLUORINE REACTIONS WITH REFRACTORY CERAMICS Final Report, Oct. 1977 - Sep. 1980
Paul C. Nordine and Daniel E. Rosner May 1981 23 p refs
(Contract F33615-77-C-5222; ARPA Order 3448)
(AD-A099691) Avail: NTIS HC A02/MF A01 CSCL 07/4

The present work has placed emphasis on the detailed kinetic and mechanistic study of selected fluorine/ceramic reactions. The results of our program include work on fluorine reaction with Al2O3 (38, 39), B4C (33, 37), Re (61, 64), Gd (61, 65), LaB6 (37, 50, 61, 63) and LaB6-C, LaB6-MoSi2 composites (61, 63). One application of materials resistant to fluorine attack at high temperature is the HF chemical laser. Nickel and nickel alloys

are useful in fluorine to ca. 1000K, but higher temperatures are required in CW HF lasers. Since the number of candidate materials decrease and fluorine corrosion rates increase with temperature it is useful to set upper bounds on the temperatures required for this application. Our analysis of this problem (61, 66) is presented. Given the temperature range of interest, the mechanisms by which fluorine gasifies solids limit the number of possible fluorine resistant materials. GRA

N81-27237# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.

COMBUSTION PROCESSES IN GRANULAR BEDS OF SOLID PROPELLANTS Final Report, 10 Jun. 1977 - 1 Mar. 1981

Kenneth K. Kuo May 1981 10 p

(Grant DAAG29-77-G-0163)

(AD-A099904; ARO-14963.6-E) Avail: NTIS HC A02/MF A01 CSCL 21/2

The combustion of granular solid propellants in a mobile bed involves many intricate physicochemical processes, such as heat transfer between gases and solid particles, flow of gas-particle mixtures, heat release resulting from the burning of granular propellants, expansion of the combustion chamber, and fluidization of the granular bed. The main features of these physical processes were simulated by the mobile granular bed combustion (MGBC) model, which requires a number of empirical correlations as input information. These correlations include: intragranular stress and particle wall friction laws, flow resistance laws for fixed and fluidized beds, convective heat-transfer correlations for both fixed and fluidized regions, and burning rate laws. Numerical computations were conducted using most realistic correlations available in the literature. Theoretical results have been compared with experimental data for both live and inert propellant grains. In the live propellant case, tests were performed in a simulated 30 caliber system. In the inert propellant case, the particle displacement, porosity distributions and pressure-time traces were obtained through the use of a transparent combustion chamber with a high-speed motion picture system and a set of high-frequency pressure transducers. The close agreement between theoretical and experimental results showed good predictability of the MGBC model. GRA

N81-27238# California Univ., Davis. Dept. of Mechanical Engineering.

DEFORMATION MODELLING IN NaCl AT INTERMEDIATE AND ELEVATED TEMPERATURES

A. Arieli, H. C. Heard, and A. K. Mukherjee 30 Dec. 1980 41 p refs Presented at TGE ASTM Symp. on Mech. Testing and Deformation Model Develop., Bal Harbor, Florida, 12-13 Nov. 1980 Prepared in cooperation with California Univ. Lawrence Livermore Lab.

(Contract W-7405-eng-36)

(UCRL-85066; CONF-801148-4) Avail: NTIS HC A03/MF A01

The flow stress dependence on temperature and strain rate of annealed, isotropic polycrystalline NaCl was determined at temperatures of 296 to 673 K. At elevated temperatures and relatively low stress the Na(+) diffusion controlled climb of dislocations was found to be the rate controlling deformation mechanism and the experimental data could be fitted by a power law function. In the same range of temperatures, at high stresses the deformation process is controlled by dislocation climb creep due to Cl(-) ion diffusion. At intermediate temperatures and low strain rates and at elevated at temperatures and high strain rates the deformation was rate controlled by the lattice resistance to the dislocation glide motion (Peierls mechanism). The constitutive equations for each deformation mechanism as well as that for the transition from one deformation mechanism to another were developed in terms of strain rate, temperature, and stress. DOE

N81-27239# Oak Ridge National Lab., Tenn.

CONTINUOUS ION EXCHANGE SEPARATION OF ZIRCONIUM AND HAFNIUM

J. M. Begovich and Warren G. Sisson 1981 13 p refs Presented at the AIME Ann. Meeting, Chicago, 22-26 Feb. 1981

(Contract W-7405-eng-26)

(CONF-810203-3) Avail: NTIS HC A02/MF A01

A pressurized continuous annular chromatography (CAC) was developed for continuous ion exchange preparative separations. This device utilizes a slowly rotating annular bed for sorbent material, fixed points, and fixed withdrawal locations. A study was made of the separation of copper, nickel, and cobalt components from a simulated carbonate leach liquor of the Caron process for recovering nickel and cobalt from laterite ores. Recent studies investigated the ion exchange separation of zirconium and hafnium from a sulfate feed solution. Nuclear reactor-grade zirconium, contaning 0.01 wt percent hafnium, and hafnium, containg 1 percent zironcium, were continuously prepared using cation exchange resin in the pressurized CAC. This device, because of its continuous feed and product withdrawal, its adaptability to largescale operations, and its ability to separate many components, is expected to make chromatography a more competitive process in the industrial sector. DOE

N81-27240# Sandia Labs., Albuquerque, N. Mex.

HIGH PRESSURE LIQUID CHROMATOGRAPHIC METHOD FOR CP AMIDE ANALYSIS

V. M. Loyola and J. E. Womelsduff Feb. 1981 26 p refs

(Contract DE-AC04-76DP-00789)

(SAND-80-2390) Avail: NTIS HC A03/MF A01

A method was developed for the analysis for the 5-carboxamidotetrazolatopentaamminecobalt(III) perchlorate contaminant of the explosive CP (2-(5cyanotetrazolato)-pentaamminecobalt(III) perchlorate). The analysis utilizes a Zn/Hg reduction of the cobalt (III) complexes to allow a high pressure liquid chromatographic (HPLC) analysis of the reaction products; the product analysis is directly related to the weight percent of impurity present in the explosive. The technique is described and shortcomings pointed out. DOE

N81-27241# Sandia Labs., Albuquerque, N. Mex.

CATALYSTS IN COAL LIQUEFACTION

M. G. Thomas 1981 10 p refs Presented at the 8th Energy Tech. Conf. and Exposition, Washington, D.C., 9 Mar. 1981

(Contract DE-AC04-76DP-00789)

(SAND-80-1751C) Avail: NTIS HC A02/MF A01

It is not clear that conventional hydrodesulfurization or hydrodenitrogenation is paramount for the early stages of coal liquefaction, although they are clearly required in upgrading. Other catalysts may be much more effective in transferring hydrogen from the solvent to the coal-derived products. Catalysts are used but are not absolutely necessary for direct coal liquefaction. Current technology utilizes catalysts primarily for upgrading and refining, relying on thermal chemistry for most of the initial reaction. Major process modifications due to catalysis are not likely under this constraint. In the absence of this limitation, the effects that catalysts have on the initial chemistry of coal liquefaction could be utilized and these effects could provide significant process improvements. DOE

N81-27242# Oak Ridge National Lab., Tenn. School of Chemical Engineering Practice.

USE OF EXTRACTIVE DISTILLATION TO PRODUCE CONCENTRATED NITRIC ACID

P. C. Campbell, T. P. Griffin, and C. F. Irwin Apr. 1981 56 p refs

(Contract W-7405-eng-26)

(ORNL/MIT-325) Avail: NTIS HC A04/MF A01

Concentrated nitric acid (greater than 95 wt %) is needed for the treatment of nitric acid by means of extractive distillation in the two pot apparatus was studied to determine the steady state behavior of the system. Four parameters, extractive distillation pot volume and temperature, acid feed rate, and solvent recycle, were independently varied. A computer simulation of the progress capable of predicting steady state conditions was developed. DOE

N81-27243# California Univ., Livermore. Lawrence Livermore Lab.

REPORT ON THE COMBUSTION MODELING PROJECT Final Report

J. W. Routh, J. R. Creighton, L. C. Haselman, C. M. Lund, and C. K. Westbrook 1 May 1981 65 p refs

(Contract W-7405-eng-48)

(UCID-18867) Avail: NTIS HC A04/MF A01

Two computer codes, one and two dimensional, are described which solve fluid dynamics equations coupled to chemical kinetic rate equations: a detailed chemical kinetics mechanism for the oxidation of methane and methanol; and a simplified model for methane combustion. The one-dimensional code, HCT, can use any reasonable size reaction set which it reads from a prepared library file. The chemical rate equations and hydrodynamic equations (Navier-Stokes), along with transport, are solved by an implicit method in a fully coupled form. The code uses adaptive gridding which places fine spatial zones in regions of high thermal gradient, such as a flame front, and coarser zones are used elsewhere. The fine zones move with the gradient. The two-dimensional code, TDC, solves fluid dynamic equations coupled to a simplified chemistry model. The code currently uses a very simple turbulence model, but could be modified for others. Special techniques are used to deal with highly subsonic flows and very thin flame fronts. DOE

N81-27244# California Univ., Berkeley. Materials and Molecular Research Div.

SYNTHESIS AND CHARACTERIZATION OF GRAPHITE-METAL FLUORIDE INTERCALATION COMPOUNDS Ph.D. Thesis

Barry W. McQuillan Apr. 1981 211 p refs
(Contract W-7405-eng-48)
(LBL-12228) Avail: NTIS HC A10/MF A01

The compound C-AsF5 was prepared and characterized by X-ray diffraction and X-ray absorption, which show the presence of AS(III) and As(V), and the As-F bond distances are consistent with C-AsF6 and AsF(+) 6, C(+)8AsF(+)6 and C(+)8OsF(+)6 were synthesized. The CxAsF6 and numerous standard arsenic-flourine compounds were studied by X-ray absorption. Magnetic susceptibility of C(+)8OsF(+)6 confirms the high degree of oxidation in this compound. The X-ray absorption studies were begun to determine the species present within the graphite when BrF3 or GeF4 + F2 are added. In the BrF3 case, Br2 is evolved and only Br(III) is present in the graphite. The binary phase diagram XeF:Xe(+)5AsF(+)6 was investigated by melting point determination and Raman spectroscopy. This mixture near 1.3:1 forms a kinetically stable glass at room temperature and is molten at 500 C. Several new species or phases are observed in the Raman spectra. These species were assigned tentative structures. DOE

N81-27245# Energy and Environmental Research Corp., Santa Ana, Calif.

ASSESSMENT OF PULVERIZED-COAL-FIRED COMBUSTOR PERFORMANCE Quarterly Technical Progress Report

W. Richter, W. Clark, and R. Payne Apr. 1981 38 p refs
(Contract DE-AC22-80PC-30297)
(DOE/PC-30297/T3; QTPR-2) Avail: NTIS HC A03/MF A01

The objective of this program is to provide the engineering tools necessary for an authoritative assessment of the performance of industrial furnaces firing pulverized coal. The program incorporates two experimental tasks and is constructed around an analytical task (Task 1) which will identify and upgrade the family of computer programs required to undertake the performance analysis studies. These analytical tools will be used on combustor performance, and to identify those properties which have a major impact on thermal performance. The second task used a combustion reactor to screen the key variables identified in Task 1 and to provide data on the properties of coal particulate matter which affect heat transfer performance. DOE

N81-27246# Energy and Environmental Research Corp., Santa Ana, Calif.

ASSESSMENT OF PULVERIZED-COAL-FIRED COMBUSTOR PERFORMANCE. MODELS FOR COAL COMBUSTOR PERFORMANCE: ANALYTICAL TOOL VERIFICATION

W. Richter Feb. 1981 96 p refs
(Contract DE-AC22-80PC-30297)
(DOE/PC-30297/T2) Avail: NTIS HC A05/MF A01

The development of mathematical models that describe the complex heat transfer processes which occur in industrial combustion chambers is discussed. These combustor models are grouped as either pure heat transfer models or as coupled fluid flow, combustion, and heat transfer models. Two models of the first type and one of the second type are described together with some basic assumptions and sample problems which illustrate their major features and capabilities. DOE

N81-27247# Bayerische Akademie der Wissenschaften, Munich (West Germany). Zentralinstitut fuer Tieftemperatureforschung.

PHYSICAL AND CHEMICAL STANDARDS OF SUPERCONDUCTION PROPERTIES OF INTERCALATION COMPOUNDS Final Report

Franz Xaver Eder and Anton Lerf Bonn Bundesministerium fuer Forschung und Technologie Nov. 1980 111 p refs Mostly in GERMAN; partly in ENGLISH Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-105; ISSN-0340-7608;
BMFT-13-N-5004/NT1094) Avail: NTIS HC A06/MF A01

The superconducting properties of the intecalation compounds of layered dichalcogenides were studied. The alkali metal intercalation derivatives of TaS2 were emphasized. The main difficulties with this class of superconductors result from varying material properties; these factors were identified and investigated. The results concern physical and chemical properties of the intercalation compounds whose phenomenological influence determine superconducting characteristics. Author (ESA)

N81-27248# Karlsruhe Univ. (West Germany). Engler-Bunte Inst.

CATALYSTS AND RELATIONS OF SELECTIVITY FOR FISCHER-TROPSCH SYNTHESIS Final Report

Hans Schulz Bonn Bundesministerium fuer Forschung und Technologie Nov. 1980 128 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-124; ISSN-0340-7608;
BMFT-03E1174A/ETS0004A) Avail: NTIS HC A07/MF A01

As a basis for desired alterations of product selectivity, the interrelations of selectivity in the Fischer-Tropsch system with cobalt and with iron catalysts are described as a function of temperature, synthetic gas composition, pressure, residence time, and type of process. An important role in this connection is attributed to analytical methods for determining product composition and to the characteristics of product selectivity (product distribution to fractions of same carbon number, methane formation, olefin portion of the hydrocarbons, olefin isomerization, skeletal isomerization, formation of alcohols). Interrelations and limitations of selectivity are evaluated in detail. Author (ESA)

N81-27249# National Materials Advisory Board, Washington, D. C. Committee on the Preparation of Ultrahigh-Purity, Low-boron Silicon.

THE PREPARATION AND CHARACTERIZATION OF SILICON FOR INFRARED DETECTORS Final Report

1981 127 p refs
(Contract MDA903-78-C-0038)
(PB81-171399; NMAB-362) Avail: NTIS HC A07/MF A01 CSCL 07A

Materials and processing requirements for IR-type silicon were analyzed and defined. The status of the related processing technology was reviewed and deficiencies were identified. The major subjects addressed are: device needs; materials and characterizaton; preparation of polycrystalline silicon; preparation of single-crystal silicon; and device process-induced contamination. GRA

N81-27250# Forintek Canada Corp., Ottawa (Ontario). Eastern Forest Products Lab.

LARGE-SCALE PRODUCTION OF POWDER ADHESIVES BASED ON KRAFT LIGNIN

A. J. Dolenko and J. A. Shields 1980 19 p refs
(PB81-150674; TR-506ER) Avail: NTIS HC A02/MF A01 CSCL 07A

Materials and processing requirements for IR-type silicon were analyzed and defined. The status of the related processing technology was reviewed and deficiencies were identified. The major subjects addressed are: device needs; materials and characterization; preparation of polycrystalline silicon; preparation of single-crystal silicon; and device process-induced contamination. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N81-27251 British Library Lending Div., Boston Spa (England).
REPORT ON THE CENIUM SUPER-ALLOYS
A. Balleret Feb. 1981 11 p Transl. into ENGLISH of Proceedings of Coll. Intern. sur les Materiaux Durs Pour Frottement Dans les Reacteurs Nucl., 25-26 Sep. 1980 p 47-55
(BLL-RTS-12501) Avail: British Library Lending Division, Boston Spa, England

The history of research pertaining to Cenium alloys is discussed with emphasis on the following research topics: inoxidizability, satisfactory hardness, satisfactory physico-mechanical characteristics, forming operations, and coefficient of friction. The usage of these alloys in nuclear reactors is briefly examined. E.D.K.

N81-27252 British Library Lending Div., Boston Spa (England).
PROPERTIES OF CENIUM ALLOYS AS HARD COBALT-FREE FRICTION MATERIALS
C. Lelong, C. Benhamou, and P. Moulin Feb. 1981 24 p refs Transl. into ENGLISH from Colloq. Intern. sur les Materiaux Durs pour Frottement dans les Reacteurs Nucl. (France), 25-26 Sep. 1980 p 147-166
(BLL-RTS-12502) Avail: British Library Lending Div., Boston Spa, England

The properties of CENIUM alloys are determined with reference to their suitability as substitutes for the cobalt base alloys currently used in the fittings for the primary circuits of pressurized water reactors. The structures of the alloys, their mechanical and physical properties, their corrosion resistance, their deposition behavior (in gas, TIG, and plasma processes), and their wear resistance in test conditions simulating those encountered in service are covered. M.G.

N81-27253 British Library Lending Div., Boston Spa (England).
COBALT BASE REPLACEMENT BY A NICKEL BASE
M. Ducos Feb. 1981 9 p refs Transl. into ENGLISH from Conf. Paper Presented at Colloq. Intern. sur les Materiaux Durs pour Frottement dans les Reacteurs Nucl., 25-26 Sep. 1980
(BLL-RTS-12503) Avail: British Library Lending Div., Boston Spa, England

Physical phenomena of nuclear power stations were studied and the replacement of cobalt based alloys by nickel based alloys was investigated and cobalt based alloys were compared to nickel based alloys, for wear, corrosion and friction, for use in nuclear reactors. Depositions by different technologies to improve the characteristics of base materials were examined. The depositions are highly utilized in cooling circuits in which cobalt is the principal alloy of the components. Two disadvantages in the utilization of cobalt are noted: (1) the primary cooling circuit fluid dissolves part of the cobalt in the depositions; (2) economically, sources of cobalt supply are very limited. E.A.K.

N81-27254 British Library Lending Div., Boston Spa (England).
Article Translating Service.
GALVANISING TECHNIQUE
Hans Henig Jan. 1981 13 p Transl. into ENGLISH from Galvanotechnik (West Germany), v. 69, no. 12, 1978 p 1091-1094
(BLL-RTS-11957) Avail: British Library Lending Div., Boston Spa, England

For the galvanizing in cylinders of mass produced parts made of metals or synthetic materials special instruments are required which take into account the specific, physical, electrochemical and unusual features of the parts. The operations of a cylinder are described which ensure a first rate degree of blending and, at the same time, maintain a constant contact among those parts not involved in the periodic blending phase. The parts of the synthetic material only mix themselves up during one fifth of their rotational period and are conditioned by means of the extraordinary filling quantity of the charges in relation to the volume of the cylinder; as a consequence, precise metallic points of contact are formed between these single parts which do not get involved in the blending process, and which piece through the separating electrofilm. The outcome of this largely excludes the formation of the dreaded bipolar effect. Whenever mass galvanizing is employed in the cylinder, each metallic effect and each color of metal on the parts of the synthetic material are produced in an economic, positive, and quick manner; copper, nickel, brass, silver, or gold plating can be carried out. A.R.H.

N81-27255 British Library Lending Div., Boston Spa (England).
THE ANALYSIS OF BENZOTRIAZOLE-CONTAINING EDGE PROTECTION COATINGS AND ETCHING AGENTS FOR PRINTED CIRCUIT MANUFACTURE
A. F. Bogenschuetz, U. Buettner, J. L. Jostan, A. Marten, and H. Merk Jan. 1981 18 p refs Transl. into ENGLISH from Galvanotechnik (West Germany), v. 69, no. 12, 1978 p 1076-1082
(BLL-RTS-11958) Avail: British Library Lending Div., Boston Spa, England

Benzotriazole is used in coatings technology as a corrosion inhibitor for copper and copper alloys, and serves as a grain fining additive, a voltage reduction agent, and a brightener in acid copper electrolytes. When used as an additive in acid copper etching agents containing chloride, benzotriazole brings about a marked degree of edge protection and thus a considerable decrease in under-etching of the conductors by forming a relatively insoluble complex compound. Investigations were undertaken to determine the stoichiometric composition of the complex compound and the structure of the edge protection layer. A suitable analytical technique for the measurement of benzotriazole in etching solutions containing heavy metals was developed. L.F.M.

N81-27256 British Library Lending Div., Boston Spa (England).
Article Translating Service.
DESIGN AND PRODUCTION OF THIN-WALLED ZINC PRESSURE DIECASTINGS, PART 2
L. deLuis Martin Feb. 1981 17 p Transl. into ENGLISH from Colada (Spain), v. 11, no. 5, 1978 p 144-148
(BLL-RTS-12171-Pt-2) Avail: British Library Lending Div., Boston Spa, England

Proper die casting temperature control prevents many casting defects. When thin walled components are attempted, automatic control is essential to keep the reject rate down to between 15% and 40%. The requirements include: (1) delaying coolant flow in the start up period, until the die reaches working temperature; (2) controlling temperature variations under steady operating conditions; and (3) stopping the coolant flow during interruptions, to reduce heat losses and reduce the number of defective castings produced before the die regains its working temperature. A recommended system for controlling the die temperature in a single zone is described as well as a multichannel temperature control system. The injection bush, heat transfer, and the cooling of slabs and strips by channels and by spray jets are discussed as well as applications of thin walled zinc alloy pressure diecast components. A.R.H.

N81-27257*# National Aeronautics and Space Administration, Washington, D. C.
OCCURRENCE OF COHESION OF METALS DURING COMBINED PLASTIC DEFORMATION
S. G. Aynbinder and E. F. Klokova Jan. 1980 14 p refs Transl. into ENGLISH from Zh. Tekhno. Fiz. (USSR), v. 25, no. 13, 1955 p 2356-2364
(Contract NASw-3198)
(NASA-TM-76587) Avail: NTIS HC A02/MF A01 CSCL 11F

Experiments were conducted to study the cohesion of metals with surface films of varying thickness and hardness. It was established that the deformation necessary for the occurrence of cohesion is determined by the correlation of mechanical properties of the films and the base metal. The greater the relative hardness of the film the lower the deformation necessary for the occurrence of cohesion. The films are as plastic as the base metal prevent cohesion, since in this case it is impossible for sections of metal to appear that are free of contaminants. The physical perculiarities of metals that determine their capability for coalescence under conditions of dry friction are the relative hardness and plasticity of the oxide films formed on their surface under atmospheric conditions. E.D.K.

N81-27258*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MATERIAL RESPONSE FROM MACH 0.3 BURNER RIG COMBUSTION OF A COAL-OIL MIXTURE
G. J. Santoro, F. D. Calfo, and F. J. Kohl Jun. 1981 24 p refs
(Contract EF-77-A-01-2593)
(NASA-TM-81686; DOE/NASA/2593-23; E-718) Avail: NTIS HC A02/MF A01 CSCL 11F

Wedge shaped specimens were exposed to the combustion gases of a Mach 0.3 burner rig fueled with a mixture of 40 weight percent micron size coal particles dispersed in No. 2 fuel oil. Exposure temperature was about 900 C and the test duration was about 44 one hour cycles. The alloys tested were the nickel base superalloys, IN-100, U-700 and IN-792, and the cobalt base superalloy, Mar-M509. The deposits on the specimens were analyzed and the extent of corrosion/erosion was measured. The chemical compositions of the deposits were compared with the predictions from an equilibrium thermodynamic analysis. The experimental results were in very good agreement with the predictions. Author

N81-27259*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED AIRCRAFT ENGINE MATERIALS TRENDS
R. L. Dreshfield, Hugh R. Gray, Stanley R. Levine, and Robert Signorelli 1981 16 p refs Presented at the 26th Ann. Intern. Gas Turbine Conf., Houston, Tex., 8-12 Mar. 1981; sponsored by ASME
(NASA-TM-82626; E-879) Avail: NTIS HC A22/MF A01 CSCL 11F

Recent activities of the Lewis Research Center are reviewed which are directed toward developing materials for rotating hot section components for aircraft gas turbines. Turbine blade materials activities are directed at increasing metal temperatures approximately 100 C compared to current directionally solidified alloys by use of oxide dispersion strengthening or tungsten alloy wire reinforcement of nickel or iron base superalloys. The application of thermal barrier coatings offers a promise of increasing gas temperatures an additional 100 C with current cooling technology. For turbine disk alloys, activities are directed toward reducing the cost of turbine disks by 50 percent through near net shape fabrication of prealloyed powders as well as towards improved performance. In addition, advanced alloy concepts and fabrication methods for dual alloy disks are being studied as having potential for improving the life of future high performance disks and reducing the amount of strategic materials required in these components. E.D.K.

N81-27260# Southern Univ., Baton Rouge, La. Dept. of Mechanical Engineering.
AN INVESTIGATION OF MECHANISMS EFFECTING ENVIRONMENTAL STRESS CRACKING IN TITANIUM ALLOY
Ira J. Graham 3 Apr. 1980 34 p refs
(Contract N00019-79-C-0137)
(AD-A096752) Avail: NTIS HC A03/MF A01 CSCL 11/6

The acoustic emission technique was applied to monitor visible crack growth and microcrack formations as energy release in real time in titanium alloy using a 12.8 millimeters (0.510 in) WOL compact specimen in a plane strain mode. The specimens were fatigued in the 30 - 60 Hz range at a determined stress intensity factor (K1) with an acoustic emission transducer at a gain of 85 dB and a bandpass frequency of 0.1 - 0.3 MHz. A stable crack advanced and microcracks formed at angles other than parallel to the advancing stable crack is intermittent energy bursts in or along the boundaries of the grains. The energy release, referred to as 'acoustic emission', is a kind of elastic stress impulse. Crack movement in the order of magnitude 10 to the minus 6 in/cyl were detected. GRA

N81-27261# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
MULTICOMPONENT OXIDE SYSTEMS FOR CORROSION PROTECTION Final Report, Jun 1977 - Sep. 1980
G. W. Stupian and Paul P. Fleischauer 15 Nov. 1980 98 p refs Prepared in cooperation with Univ. of Southern California (Grant AF-AFOSR-3334-77; AF Proj. 2303)
(AD-A099995; ATR-81(7679)-1; AFOSR-81-0472TR) Avail: NTIS HC A05/MF A01 CSCL 11/3

The formation and function of corrosion resistant surface oxide films on aluminum were investigated during a three year research effort. The structures of the mixed oxide coatings studied were characterized using Auger electron spectroscopy, X-ray photoelectron spectroscopy, and ion microprobe mass analysis. Corrosion resistance was assessed by exposing specimens in a salt chamber. Chromate coating systems were examined to provide a standard against which to measure coating performance. Titanium-aluminum mixed oxide coatings, deposited from solutions of titanium alkoxides in isopropanol, served as a prototype system for much of this work. It was found that the application of certain sulfur compounds in conjunction with titanate coatings resulted in enhanced corrosion resistance and in one case the corrosion resistance exceeded that of the chromate coatings. E.D.K.

N81-27262# Idaho National Engineering Lab., Idaho Falls.
EFFECT OF FOUR SIMULATED COAL GASIFIER ATMOSPHERES ON THE BIAXIAL STRESS RUPTURE BEHAVIOR OF FOUR CANDIDATE COAL GASIFIER ALLOYS
R. M. Horton 1980 34 p refs Presented at the Am. Soc. of Metals Conf., Pittsburgh, 28 Oct. 1980
(Contract DE-AC07-76ID-01570)
(CONF-8010162-1) Avail: NTIS HC A03/MF A01

Tests were conducted on four alloys (Type 310 stainless steel, Incoloy 800H, Haynes 188, and IN-657) which are candidates for use in coal gasifiers to determine whether their hundred hour biaxial stress rupture strength and life were adversely affected by exposure to four simulated coal gasifier atmospheres. Exposure to these atmospheres at temperatues below 1172 K (1650 F) did not decrease these rupture properties below measured in air. Only at 1255 K (1800 K) were the rupture properties in the various atmospheres consistently below those measured in air at atmospheric pressure. Corrosion coupon tests of Inconel 600, Incoloy 800, and Type 309 stainless steel in CGA verified data obtained from similar tests by other laboratories. DOE

N81-27263# California Univ., Berkeley. Lawrence Berkeley Lab.
HIGH-STRENGTH AUSTENITIC ALLOYS FOR GENERATOR RETAINING RINGS Interim Report
K. M. Chang Apr. 1981 93 p refs Sponsored in part by Electric Power Research Inst.
(Contract W-7405-eng-48; EPRI Proj. 636-2; EPRI Proj. 1266-12)
(EPRI-CS-1808) Avail: NTIS HC A05/MF A01

The development of an alternative alloy for retaining rings of electrical generators is discussed. The alloy is to be nonmagnetic, heat treatable, and capable of achieving high yield strength levels in combination with high toughness and resistance to stress corrosion cracking. E.D.K.

N81-27264# Ad-Ex International, Portola Valley, Calif.
PROCESS FOR THE EXTRACTION OF HEAVY METALS DISSOLVED IN SEAWATER
Dieter Heitkamp and Klaus Wagener Feb. 1981 26 p Transl. into ENGLISH of West German Patent no. 2711609 (17 Mar. 1977)
(Contract W-7405-eng-48)
(UCRL-Trans-11677) Avail: NTIS HC A03/MF A01

A process is claimed for the extraction of heavy metals, particularly uranium, which are dissolved in seawater. The heavy metals are concentrated by adsorption on a matrix materials of natural black peat. The procedure involves the following steps: adsorber matrix of black peat containing a biologically recent humic acid and having a maximum of 90% by weight of material serving as the carrier material for the humic acid is placed in contact with seawater until as high a proportion as possible of heavy metals are adsorbed; adsorber matrix is removed from seawater and the heavy metals are extracted with dilute hydrochloric acid which is made by the electrolytic decomposition of sodium chloride in the seawater; the extract is adjusted to a pH range of 4 to 8 with hydroxide which is also prepared by the electrolytic decomposition of sodium chloride in the seawater;

the eluate is treated again with an adsorber matrix containing humic acid for further concentration of the heavy metals, and the metals are finally processed off as metal salts. DOE

N81-27265# Ohio State Univ., Columbus. Dept. of Metallurgical Engineering.
FUNDAMENTAL STUDIES OF HIGH-TEMPERATURE CORROSION REACTIONS Annual Progress Report
Robert A. Rapp Feb. 1981 51 p refs
(Contract DE-AC02-79-ER-10404)
(DOE/ET-10404/2; APR-6) Avail: NTIS HC A04/MF A01

Research was conducted on the sulfidation of pure M by sulfur gases at 700 to 9500 C and on the in situ oxidation of metals and alloys in the hot-stage SEM. Results on the in situ oxidation of Cu, Ni, Fe, and Cu-6% Ni up to 9300 C are reported in detail. DOE

N81-27266# ECA, Inc., Woodridge, Ill.
CORROSIVITY OF PROPYLENE GLYCOL SOLUTION IN SOLAR-ENERGY FLUID SYSTEM
Sep. 1980 28 p refs
(Contract W-31-109-eng-38)
(ANL/EES/TM-131) Avail: NTIS HC A03/MF A01

Degradation of inhibited gylcol solution leads to corrosion of metals in a solar energy system. Corrosion was monitored at three sites. To evaluate the extent at corrosion, accelerated laboratory tests were performed. These tests were directed toward controlling fluid corrosion in solar energy systems. DOE

N81-27267# Sandia Labs., Albuquerque, N. Mex.
INVESTIGATION OF STRETCH FORMABILITY OF SHEET METALS
R. Helms and J. Ziebs Apr. 1981 227 p refs Transl. into ENGLISH from "Untersuchungen zur Erfassung der Kaltformbarkeit von Feinblechen beim Strecken" Research Rept. 60, Federal Inst. for Mater. Testing, Berlin, Aug. 1979
(Contract DE-AC04-76DP-00789)
(SAND-81-6007) Avail: NTIS HC A11/MF A01

Tensile tests involving determination of the normal anisotropy r and the work hardening exponent n were used in the usual way in order to compare the stretch forming behavior of metallic materials in the form of sheets and ribbons. In addition, simulative testing methods were developed in which the maximum attainable stretch forming limits, can be determined between the stress ratios (-) = sigma2/sigma1 = 0....1. DOE

N81-27268# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
THE RECLAMATION OF IMPROPERLY CADMIUM ELECTROPLATED HIGH STRENGTH STEEL PARTS
H. P. VanLeeuwen, P. Derijk, J. A. M. Boogers, H. N. Huisman, and R. J. H. Wanhill Apr. 1979 13 p refs
(NLR-TR-79046-U) Avail: NTIS HC A02/MF A01

Circumferentially notched round specimens of 4340 type steel were cadmium plated in a galvanic bath known to be embrittling. The specimens were reclaimed by stripping and baking. Half the specimens were replated in a nonembrittling bath. Specimens were subjected to a sustained load. If failure had not occured within 1000 HR, the load was raised to a higher level for another 1000 HR and so on until failure occured. Fractography was performed on specimens experiencing delayed and fast fracture. Reclamation does not remove all traces of hydrogen embrittlement, but raises the threshold stress to such a level that hydrogen embrittlement is no longer a hazard under normal circumstances. Author (ESA)

N81-27269# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
THE CORROSION RESISTANCE OF TWO COATINGS APPLIED TO ALLISON 250-C20B BLADES
H. J. Kolkmann Dec. 1979 15 p refs
(NLR-TR-79125-U) Avail: NTIS HC A02/MF A01

Blades made of 17-4 PH steel were coated with A-12 and with Sermetal 735. The coated blades were tested with neutral and acid salt sprays and in a compressor rig. These studies were undertaken as a result of the disintegration of an Allison 250-C20B compressor from a BO-105C helicopter. Corrosion pits were found on the concave sides of the rotor blades and in the vane root areas nominally covered by a plastic coating. The salt spray tests did not simulate real conditions as they did not produce the observed pitting. The compressor rig test did simulate operational conditions. It also demonstrated the ability of the coatings to protect the blades. Author (ESA)

N81-27270# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
S-N CURVE CONSTRUCTION FOR ALUMINUM FORGING ALLOYS
L. Schra and R. J. H. Wanhill Jun. 1980 15 p ref Submitted for publication
(NLR-MP-80026-U) Avail: NTIS HC A02/MF A01

Analytical and freehand approaches to fitting S-N curves were examined. Guidelines are derived from the data for freehand curves. At stress levels for which all specimens fail before 10 to the 7th power cycles, the S-N curve is based on the logarithmic mean life. The fatigue limit must always be higher than a stress level at which all specimens remain unbroken. The fatigue limit is taken to be the nearest integral stress amplitude value in MPa at 10 to the 7th power cycles. At stress levels for which specimens exhibit lifetimes other than the above, the fatigue limit is lower and is determined from the ratio between the failed and total number of specimens and the differences between stress levels. Author (ESA)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N81-27271* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PROCESS FOR THE PREPARATION OF POLYCARBORANYLPHOSPHAZENES Patent
Harry R. Allcock (Pennsylvania State Univ., University Park), John P. Obran (Pennsylvania State Univ., University Park), Angelo G. Scopelianos (Pennsylvania State Univ., University Park), and Larry L. Fewell, inventors (to NASA) (Pennsylvania State Univ., University Park) Issued 30 Jun. 1981 3 p Filed 12 Mar. 1980 Supersedes N80-21464 (18 - 12, p 1541) Sponsored by NASA
(NASA-Case-ARC-11176-2; US-Patent-4,276,403; US-Patent-Appl-SN-129798; US-Patent-Class-528-4; US-Patent-Class-528-168; US-Patent-Class-528-399; US-Patent-Class-528-6) Avail: US Patent and Trademark Office CSCL 07C

A process for the preparation of polycarboranylphosphazenes is described. Polydihalophosphazenes are allowed to react at ambient temperatures for at least one hour with a lithium carborane in a suitable inert solvent. The remaining chlorine substituents of the carboranyl polyphosphazene are then replaced with aryloxy or alkoxy groups to enhance moisture resistance. The polymers give a high char yield when exposed to extreme heat and flame and can be used as insulation.
Official Gazette of the U.S. Patent and Trademark Office

N81-27272* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PHOSPHORUS-CONTAINING BISIMIDE RESINS Patent
Indra K. Varma (NAS-NRC, Washington, D.C.), George M. Fohlen (NAS-NRC, Washington, D.C.), and John A. Parker, inventors (to NASA) (NAS-NRC, Washington, D.C.) Issued 30 Jun. 1981 4 p Filed 5 Aug. 1980 Supersedes N80-31551 (18 - 22, p 2976)
(NASA-Case-ARC-11321-1; US-Patent-4,276,344; US-Patent-Appl-SN-175452; US-Patent-Class-428-260; US-Patent-Class-428-367; US-Patent-Class-428-408; US-Patent-Class-428-902; US-Patent-Class-428-920; US-Patent-Class-526-262; US-Patent-Class-528-228) Avail: US Patent and Trademark Office CSCL 07C

The production of fire-resistant resins particularly useful for making laminates with inorganic fibers such as graphite fibers is discussed. The resins are by (1) condensation of an ethylenically unsaturated cyclic anhydride with a bis(diaminophenyl) phosphine

oxide, and (2) by addition polymerization of the bisimide so obtained. Up to about 50%, on a molar basis, of benzophenonetetracarboxylic acid anhydride can be substituted for some of the cyclic anhydride to alter the properties of the products. Graphite cloth laminates made with these resins show 800 C char yields greater than 70% by weight in nitrogen. Limiting oxygen indexes of more than 100% are determined for these resins.
Official Gazette of the U.S. Patent and Trademark Office

N81-27273 British Library Lending Div., Boston Spa (England).
TENSIDES AND POLYMERS: AGENTS FOR TERTIARY RECOVERY OF CRUDE OIL IN HIGHLY SALINE SYSTEMS
M. Akstinat Nov. 1980 29 p refs Transl. into ENGLISH of Tenside Detergents (West Germany), v. 17, no. 1, 1980 p 1-9
(BLL-RTS-12452) Avail: British Library Lending Div., Boston Spa, England

The importance and necessity for tertiary crude oil recovery processes are discussed in relation to economic factors. The development and characterization of viscous flooding media for use in oil recovery are described. E.D.K.

N81-27274 British Library Lending Div., Boston Spa (England).
ON THE THEORY OF THE TENSILE STRENGTH OF AGGLOMERATES DURING THE TRANSMISSION OF POWER AT CONTACT POINTS
H. Rumpf (Karlsruhe Univ.) Jan. 1981 16 p refs Transl. into ENGLISH from Chem. Ingr. Tech. 42 (8) (Karlsruhe), p 538-540
(BLL-RTS-12087) Avail: British Library Lending Div., Boston Spa, England

The assessment of tensile strength becomes difficult in the case of agglomerates made up of particles of random sizes. Two correlations are illustrated which enable tensile strength to be calculated on the basis of particle size which may be determined experimentally. E.D.K.

N81-27275 British Library Lending Div., Boston Spa (England).
METHODS FOR INVESTIGATING THE STRUCTURE FORMATION AND ESTIMATING THE FILLER ACTIVITY IN POLYMER COMPOUNDS
S. N. Tolstaja Jan. 1981 24 p refs Transl. into ENGLISH from Faserforsch. und Textiltech. (USSR), v. 29, no. 1, 1978 p 25-31 Lecture presented at 3d Intern. Microsymp. on Polymer Composition, Berlin, 25-26 Apr. 1977
(BLL-RTS-12099) Avail: British Library Lending Div., Boston Spa, England

The structure formation of filler suspensions in polymer solutions as a model of filled polymers is considered. A method for measuring the strength which is based on the static limiting shear stress of a small plate situated in the system is described. The influence of the concentration of filler and polymer solution on the structure forming activity of surface active modifiers is demonstrated. The use of the model suspensions for determining the activity of fillers and optimum conditions for their activation by tensides and polymers is established. E.A.K.

N81-27276 British Library Lending Div., Boston Spa (England). Article Translating Service.
GRAFTING OF VINYL COMPOUNDS ON TO POLYAMIDES
Kien VanPhung and Rolf C. Schulz Feb. 1981 7 p refs Transl. into ENGLISH from Macromolekulare Chemie (West Germany), v. 180, no. 7, 1979 p 1825-1927
(BLL-RTS-12245) Avail: British Library Lending Div., Boston Spa, England

Grafting to the N-atoms of polyamides is discussed. Under the influence of a reducing agent intermediate polymer N-radicals are formed. The redox reaction between N-Chlorsuccinimide and hydrazinehydrate or iron amonium sulfate induces the polymerization of acrylonitril and acrylamide in an aqeous medium. It is suggested that graft copolymers should be produced with polymer N-chloramides. Polamides are reprecipitated and converted into poly(N-chloramides). The reaction occurs predominantly on the particle surface. E.A.K.

N81-27277*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONTACT ANGLE MEASUREMENTS OF A POLYPHENYL ETHER TO 190 C ON M-50 STEEL
William R. Jones, Jr. Jun. 1981 16 p refs
(NASA-TM-82628; E-881) Avail: NTIS HC A02/MF A01 CSCL 07C

Contact angle measurements were performed for a polyphenyl ether on steel in nitrogen. A tilting plate and a sessile drop apparatus were used. Surface tension was measured with a maximum bubble pressure apparatus. Critical surface energies of spreading were found to be 30.1 and 31.3 dynes/cm. It was concluded that the polyphenyl ether is inherently autophobic and will not spread on its own surface film. Author

N81-27278*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A REVIEW OF HIGH-TEMPERATURE ADHESIVES
Anne K. St.Clair and Terry L. St.Clair Jul. 1981 22 p refs
(NASA-TM-83141) Avail: NTIS HC A02/MF A01 CSCL 11A

The development of high temperature adhesives and polyphenylquinoxalines (PPQ) is reported. Thermoplastic polyimides and linear PPQ adhesive are shown to have potential for bonding both metals and composite structures. A nadic terminated addition polyimide adhesive, LARC-13, and an acetylene terminated phenylquinoxaline (ATPQ) were developed. Both of the addition type adhesives are shown to be more readily processable than linear materials but less thermooxidatively stable and more brittle. It is found that the addition type adhesives are able to perform, at elevated temperatures up to 595 C where linear systems fail thermoplastically. E.A.K.

N81-27279*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CROSS-LINKED POLYVINYL ALCOHOL AND METHOD OF MAKING SAME Patent Application
Dean W. Sheibley, Lorra L. Rieker, Li-Chen Hsu, and Michelle A. Manzo, inventors (to NASA) Filed 10 Jun. 1981 14 p
(NASA-Case-LEW-13504-1; US-Patent-Appl-SN-272234) Avail: NTIS HC A02/MF A01 CSCL 07C

A method is described for producing cross-linked polyvinyl alcohol battery separators. A film-forming polyvinyl alcohol resin is admixed, in aqueous solution, with a dialdehyde cross-linking agent which is capable of cross-linking the polyvinyl alcohol resin and a water soluble acid aldehyde. The acid aldehyde contains a reactive aldehyde group, capable of reacting with hydroxyl groups in the polyvinyl alcohol resin, and an ionizable acid hydrogen atom. The amount of acid aldehyde is from 1 to 5% by weight and is sufficient to reduce the pH of the aqueous admixture to 5 or less. The admixture is then formed into a desired physical shape, such as by casting a sheet or film, and the shaped material is then heated to simultaneously dry and cross-link the article. NASA

N81-27280# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
TOUGHENING OF ANHYDRIDE CURED EPOXY RESINS
Amir Hussain (Siemens A.G., Munich) and F. J. McGarry Mar. 1980 19 p refs
(MIT-RR-R80-2) Avail: NTIS HC A02/MF A01

Anhydride cured diglycidylether of bisphenol-A epoxy are toughened against crack propagation by incorporating functionally terminated liquid butadiene-acrylonitrile rubber (CTBN). Spherical domains of 2 to 3 micrometer in diameter are formed in situ during cure. With increasing amounts of rubber, the size of the second phase particles decreases. Thermomechanical and dielectric properties of the modified resins deteriorate rapidly beyond 10% rubber content. The temperature of the unmodified system is 129 C; it drops to 126 C with 10 parts rubber and to 119 C with 20 parts. The excess rubber appears to copolymerize with the matrix resin and the coefficients of thermal expansion increases disproportionately. The appearance and growth of secondary relaxation peaks in the dielectric spectra due to nitrile groups may be associated with the plasticizing effect of the excessive rubber. E.D.K.

N81-27281*# George Washington Univ., Washington, D.C.
LOW-ENERGY ELECTRON EFFECTS ON TENSILE MODULUS AND INFRARED TRANSMISSION PROPERTIES OF A POLYPYROMELLITIMIDE FILM
James E. Ferl (Joint Inst. for Advancement of Flight Sciences,

Hampton, Va.) and Edward R. Long, Jr. Jun. 1981 18 p refs (NASA-TM-81977; L-13935) Avail: NTIS HC A02/MF A01 CSCL 07D

Infrared (IR) spectroscopy and tensile modulus testing were used to evaluate the importance of experimental procedure on changes in properties of pyromellitic dianhydride-p,p prime-oxydianiline film exposed to electron radiation. The radiation exposures were accelerated, approximate equivalents to the total dose expected for a 30 year mission in geosynchronous Earth orbit. The change in the tensile modulus depends more on the dose rate and the time interval between exposure and testing than on total dose. The IR data vary with both total dose and dose rate. A threshold dose rate exists below which reversible radiation effects on the IR spectra occur. Above the threshold dose rate, irreversible effects occur with the appearance of a new band. Post-irradiation and in situ IR absorption bands are significantly different. It is suggested that the electron radiation induced metastable, excites molecular states. E.A.K.

N81-27282*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CORRELATION OF IDEAL AND ACTUAL SHEAR STRENGTHS OF METALS WITH THEIR FRICTION PROPERTIES

Kazuhisa Miyoshi and Donald H. Buckley Jul. 1981 12 p refs

(NASA-TP-1891; E-701) Avail: NTIS HC A02/MF A01 CSCL 11F

The relation between the ideal and actual shear strengths and friction properties of clean metals in contact with clean diamond, boron nitride, silicon carbide, manganese-zinc ferrite, and the metals themselves in vacuum is discussed. An estimate of the ideal shear strength for metals is obtained from the shear modulus, the repeat distance of atoms in the direction of shear of the metal, and the interplanar spacing of the shearing planes. The coefficient of friction for metals is shown to be correlated with both the ideal and actual shear strength of metals. The higher the strength of the metal, the lower the coefficient of friction occurs. Author

N81-27283# Northwestern Univ., Evanston, Ill. Dept. of Chemistry.

COFACIAL ASSEMBLY OF METALLOMACROCYCLES. A MOLECULAR ENGINEERING APPROACH TO ELECTRICALLY CONDUCTIVE POLYMERS Interim Technical Report

Carl W. Dirk, Karl E. Schoch, Jr., and Tobin J. Marks 13 May 1981 24 p refs Submitted for publication

(Contract N00014-77-C-0231; NR Proj. 053-640)

(AD-A099520; TR-15) Avail: NTIS HC A02/MF A01 CSCL 07/4

This paper discusses a strategy to control molecular stacking interactions in low-dimensional mixed valence materials by locking partially oxidized metallomacrocycles together in a face-to-face orientation. Thus, doping of the cofacially linked oligomers (M(Pc)O)n(M = Si, Ge, Sn; Pc = phthalocyaninato) with halogen (I2, Br2) or quinone (e.g., TCNQ, DDQ) electron acceptors produces robust, electrically conductive polymers with a wide range of stoichiometries and properties. The new materials have been studied by a variety of physical methods including X-ray diffraction, resonance Raman and infrared spectroscopy, ESR, static magnetic susceptibility, and variable-temperature four-probe electrical conductivity. Evidence is presented that some of the polymers have 'metal-like' conductivity in the stacking direction and that transport properties within the series can be readily manipulated by rational variation of lattice architecture (e.g., the identity of the metal, M) and acceptor characteristics. GRA

N81-27284# Delaware Univ., Newark.

MICROSTRUCTURE DEVELOPMENT IN POLYMERS Final Report

Jerold M. Schultz 12 May 1981 11 p refs

(Contract DAAG29-79-C-0187)

(AD-A099535; ARO-14865.10-MS) Avail: NTIS HC A02/MF A01 CSCL 11/9

The development of microstructure is unperturbed and in deformed polymer melts and solids has been studied. In much of the work the Oak Ridge 10-Meter SAXS Instrument has been used. For undeformed systems, results relate to the geometry and phase properties of the crystallizing material. For deformed systems, a complex sequence of events is described: basically the rapid formation of fibrillar, imperfect crystals and their subsequent internal rearrangements. Mechanical property development is related to the observed changes. Author (GRA)

N81-27285# Illinois Univ. at Urbana. Materials Research Lab.

ELECTRONIC STRUCTURE AND TRANSPORT PROPERTIES OF SEMI-CONDUCTING POLYMERS Final Technical Report, 1 Jul. 1979 - 30 Jun. 1980

A. Barry Kunz 22 Sep. 1980 12 p refs

(Contract F49520-79-C-0215; AF Proj. 2301)

(AD-A099888; AFOSR-81-1075TR) Avail: NTIS HC A02/MF A01 CSCL 07/3

The aim of this project initially was to develop accurate non-parametric methods for determining the energy band structure of semi-conducting polymers and then to incorporate within the same model a method to determine the electron levels due to impurity atoms used as replacements for the side groups about the polymer back bone. Secondly, we were to study the energy structure of several polymers with and without impurity side groups. These tasks have been successfully accomplished. Author (GRA)

N81-27286# Grumman Aerospace Corp., Bethpage, N.Y. Advanced Manufacturing and Materials Development Sect.

METALLIC COATINGS FOR GRAPHITE/EPOXY COMPOSITES Final Report, 16 Oct. 1978 - 31 Jul. 1980

Christian J. Staebler, Jr. and Bonnie F. Simpers Aug. 1980 81 p refs

(Contract N00019-78-C-0602)

(AD-A099702) Avail: NTIS HC A05/MF A01 CSCL 11/3

Metallic coating systems for graphite/epoxy laminated aircraft structures were developed to provide protection against moisture penetration, electromagnetic interference (EMI), paint strippers and lightning strikes. Foil coatings and pressed powder coatings were evaluated to assess their resistance to these hostile environments. The foil coatings provided a significant reduction in the moisture penetration and the associated strength loss of the laminate after exposure to humidity and humidity-thermal spiking. Techniques were developed for the application of foil coatings to graphite/epoxy laminates. Solid and perforated aluminum foil were applied to cured laminates in a secondary bonding operation. Sulfur dioxide/salt spray testing performed on foil-coated laminates did not indicate a severe corrosion problem. Author (GRA)

N81-27287# Kingston Polytechnic, Kingston-Upon-Thames (England).

THE FRACTURE OF THERMOSETTING RESINS AFTER EXPOSURE TO WATER Annual Technical Report, Oct. 1979 - Oct. 1980

Geoffrey Pritchard and R. G. Rose Sep. 1980 47 p refs

(Contract DAJA37-79-C-0505; DA Proj. 1T1-61102-BH-57)

(AD-A099975; ATR-1) Avail: NTIS HC A03/MF A01 CSCL 11/9

Advanced composite materials should be able to withstand hot, wet conditions. This investigation is concerned with organic, cross-linked resins and specifically with unsaturated polyester resins. The aim was to determine the extent of loss of fracture toughness of the unreinforced resins as a result of immersion in hot water. Data are presented for one polyester resin, immersed in water at 30 C and at 65 C for nearly two years. A theory of degradation is outlined. The findings are currently being extended to a series of resins differing only in molecular weight distribution and in number-average molecular weight. The outcome should be the establishment of optimum molecular weight distributions. Author (GRA)

N81-27288# Reluxtrol Co., San Francisco, Calif.

ELECTROMAGNETIC TESTING OF CERAMIC MATERIALS: A FEASIBILITY STUDY Final Report

L. Y. L. Shen and D. P. Johnson Feb. 1981 35 p refs Sponsored by EPRI

(EPRI Proj. 109-5)

(EPRI-EM-1698) Avail: NTIS HC A03/MF A01

The anomalously large crack signal and lift off signals

obtained from certain ceramics with focused field electromagnetic testing methods are defined. The anomalously large crack signals observed in conducting ceramics are explained in terms of the bulk electrical conductivity being lower than the near surface conductivity. The anomalously large lift off signals obtained from semiconducting and insulating ceramics are explained in terms of capacitance coupling through the test material. The feasibility of using focused field electromagnetic test methods in beta double prime aluminas was examined. Cracks were detected in beta double prime aluminas but the dependence of crack detection upon crack size and conductivity was not determined. Conductivity differences were also measured. A method for inhancing crack detection in beta double prime alumina by increasing the surface conductivity relative to the bulk conductivity is suggested. DOE

N81-27289# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
INFLUENCE OF GRAIN BOUNDARY SILICA IMPURITY ON ALUMINA TOUGHNESS
J. S. Moya (Inst. de Ceramica y Vidrio), W. M. Kriven, and J. A. Pask Aug. 1980 8 p refs Presented at the 7th LLR/MMRD Intern. Symp. of Interfaces in Glass-Metal Systems, Berkeley, Calif., 28 Jul. 1980
(Contract W-7405-eng-48)
(LBL-12190; CONF-800765) Avail: NTIS HC A02/MF A01

The effect of silica impurity on aggregation state and on electropheretic, pressing, filtering and sintering behavior on alumina powders is presented. Results show that the silica surface impurity plays an important role in the ceramic processing of powders by decreasing the pH values of the isoelectric point (i.e.p.), which affects the aggregation state of the powder; and decreasing the compactability and the activation energy for the initial stage of sintering. Emphasis was given to the effect of the presence of silica impurity on the toughness and fracture behavior of alumina samples. DOE

N81-27290# General Electric Co., St. Petersburg, Fla.
ELECTRICAL FIELD ASSISTED BONDING OF ALUMINUM TO GLASS
A. J. Mione 7 May 1981 35 p refs
(Contract DE-AC04-76DP-00656)
(GEPP-TIS-531) Avail: NTIS HC A03/MF A01

In this two-phase study, electrical field assisted bonding tests on a variety of phosphorus, lead, silica and borosilicate glasses demonstrated that thin aluminum foil can be sealed to all but pure silica and ferroelectric materials at temperature below 4500 C. Thin foils accommodated to major surface irregularities, and bonded consistently to ground, as compared to optically polished, glass surfaces. Aluminum foils up to 0.0105-in. thick were bonded to a selected borosilicate glass (Corning 7052) at temperatures up to 5000 C. Alternating aluminum and glass stacked specimens were produced by electrical field reversal. DOE

N81-27291# California Univ., Livermore. Lawrence Livermore Lab. Materials and Processes Lab.
FABRICATION AND SPIN TEST OF THICK, LAMINATED s2-GLASS FLYWHEEL DISCS
R. P. Nimmer, K. A. Torossian, and J. S. Hickey 16 Apr. 1981 44 p refs
(Contract W-7405-eng-48)
(UCRL-15308) Avail: NTIS HC A03/MF A01

The results of a program to fabricate and test model flywheels made of thick laminated S2-glass are presented under 5 headings, i.e., fabrication of thick, laminated discs; failure criterion for these laminated discs; spin tests on laminated discs; manufacture and characterization of the filament wound outer rings; and assembly and spin testing of complete hybrid disc-ring flywheels. It was demonstrated that laminated discs up 3.6 cm (1.4 in.) thick can be manufactured with fiber volume content between 48 to 50% and void content less than 1.8% for application to flywheel energy storage. Analysis indicated that initial damage to the matrix of such discs will occur at the center of the disc at comparatively low tip speeds. This was observed, but the initiation of damage did not seem to be closely related to ultimate failure. Hybrid disc-ring flywheels composed of S2-glass/epoxy, laminated discs and filament wound, graphite/epoxy rings assembled with an interference fit were successfully fabriated. Initial spin tests substantiated analytical predictions of initial damage due to delamination of the outer ring. GRA

N81-27292# Sandia Labs., Albuquerque, N. Mex.
ELECTRICAL PROPERTIES OF CONDUCTING ELASTOMERS
G. E. Pike Apr. 1981 80 p refs
(Contract DE-AC04-76-DP-00789)
(SAND-81-0263) Avail: NTIS HC A05/MF A01

Experimental and theoretical results are presented to characterize and explain the mechanism of electrical conduction in some metal loaded silicone elastomers. Four commercial elastomers were studied, each with different metal particles. The resistivity was measured as a function of temperature and tensile and compressive strain. The temperature dependence in all elastomers was close to that for the resistivity of the metal particles. DOE

N81-27293# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
POLYSULFONES FOR CONSERVATION IN THE ETHYLENE-POLYMER INDUSTRY Progress Report, Jul. - Sep. 1980
Meyer Steinberg, Hee Ju Yoo, David Elling, Philip Bernstein, and Alan E. Varker Jan. 1981 26 p refs
(Contract DE-AC02-76CH-00016)
(BNL-51353; PR-9) Avail: NTIS HC A03/MF A01

The preparation of ethylene-SO2 polysulfone copolymers by cobalt-60 gamma irradiation, as well as by chemical catalysis, as a means of incorporating a polluting waste material such as SO2 into useful ethylene polymers and also for the purpose of conserving ethylene feedstock is described. The physical properties of the copolymer were determined, and it was found that the copolymer is soluble in ethylene diamine and its homologues, hot concentrated H2SO4, and cold 45% KOH. It was also found that it had no glass transition temperature, Tg, and no crystalline melting temperature, Tm, but had a decomposition temperature near 3500 C. The copolymer was pressure molded into discs at elevated temperatures, 150 to 2000 C, which had a high degree of hardness but were brittle and inhomogeneous (partly clear and partly cloudy). Sheets of the copolymer were also prepared by mixing the powdered copolymer with 4 to 5% Teflon powder on a hot tow-roll mill. The addition of small quantities of a third monomer resulted in products containing copolymers of the modifying monomer. These modified polymers appeared soluble in common solvents. DOE

N81-27294# Solaramics, El Segundo, Calif.
CELLULAR-GLASS CONTINUOUS PROCESS Final Report
Aug. 1980 85 p
(Contract DE-AC04-76DP-00789)
(SAND-79-8186) Avail: NTIS HC A05/MF A01

The objective of the program is to develop and demonstrate feasibility of processing techniques required for continuous production of cellular glass suitable for heliostat reflective module substrates. The concept of utilizing cellular foamed glass for the mirror module substrate is described. Characteristics which need attention are: the availability and cost addressed throughout the continuous process; improved strength and reduced weight achieved by variable density through the thickness, i.e., generation of a dense skin over a lightweight core to achieve a more efficient sandwich structure; and improved environmental and impact resistance which is achieved by closed cell structure and the dense surface skin. Sections cover in detail heliostat application (design consideration and requirements, mechanical properties of cellular glass, sandwich panel design analysis); production process description; operational experience; test material evaluation; and cost projections. A summary of events for a 20-day run for the production of a batch is presented. DOE

N81-27295# Sandia Labs., Albuquerque, N. Mex.
APPLICATION OF DRY-POLISHING TECHNIQUES TO WATER-SOLUBLE GLASS CERAMICS
J. T. Healey and Mark E. McAllaster Apr. 1981 17 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-1927) Avail: NTIS HC A02/MF A01

A dry polishing technique is presented for the preparation of glass ceramics for microstructural characterization. The technique is shown to be applicable to water soluble phosphate

based glass ceramics and also to a non water soluble zinc silicate glass ceramic. Microstructural characterization is performed primarily with composition backscattered electron imaging in the scanning electron microscopy. Some relief is observed on the polished surface utilizing topograhical backscattered electron imaging. DOE

N81-27296# National Bureau of Standards, Washington, D.C. National Meaurement Lab.
EFFECT OF STRAIN RATE ON THE FRACTURE TOUGHNESS OF OF SILICON NITRIDE AT 1400 C Interim Report
R. J. Fields, N. J. Tighe, and E. R. Fuller, Jr. Oct. 1980 25 p refs Sponsored in part by DOE
(PB81-166670; NBSIR-79-1960) Avail: NTIS HC A02/MF A01 CSCL 11B

The critical stress intensity factor for fracture, K sub 1 C was measured in Si_3N_4 at 1400 C as a function of strain rate. It was found that K sub 1 C increased with decreasing rates of bending of notched bars. Predictions using a time dependent plastic zone correction to K sub 1 C are evaluated. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N81-27297*# Florida Inst. of Tech., Melbourne. Dept. of Mechanical Engineering.
HANDBOOK ON HYPERGOLIC PROPELLANT DISCHARGES AND DISPOSAL
Thomas E. Bowman, Henry E. Sivik, and John J. Thomas Jan. 1977 367 p refs
(Contract NAS10-8399)
(NASA-CR-166826; DD-MDD-41) Avail: NTIS HC A16/MF A01 CSCL 21I

The efficiency of all treatment methods formerly or currently used in treating chemical wastes is assessed with emphasis on the disposal of hypergolic propellants. Maximum focus is on the space shuttle propellants MMH and N_2O_4. Except for hydrogen peroixde oxidizers, all the propellants are nitrogen based and can be potentially reduced to valuable plant nutrients. In theory, all the propellants can be reduced to carbon, hydrogen, nitrogen, and oxygen, except of fuming nitric acid which contains a small amount of fluorine. Appendices cover: (1) a general design criteria for disposal ponds; (2) thermal aspects of reaction in dilute solution; (3) gas bubble growth, detachment, and rise (4) absorption scrubber fundamentals and descriptions; (5) separation of a propellant vapor from a helium stream by permeation; and (6) atmospheric emission limits. A.R.H.

N81-27298# Air Force Academy, Colo.
THERMOCHEMICAL DECOMPOSITION OF TNT: RADICAL IDENTIFICATION AND THEORETICAL STUDIES Interim Technical Report, Jun. 1980 - Mar. 1981
Larry P. Davis, Almon G. Turner, W. Robert Carper, John S. Wilkes, and R. Cameron Dorey Apr. 1981 28 p refs
(AF Proj. 2303)
(AD-A099044; FJSRL-TR-81-0002) Avail: NTIS HC A03/MF A01 CSCL 07/3

The thermochemical decomposition of 2,4,6-trinitrotoluene (TNT) has been studied experimentally with EPR and theoretically with the MNDO and MINDO/3 methods. Analysis of the EPR spectra of pure TNT and hexamethylbenzene (HMB)-doped TNT at elevated temperatures has afforded an identification of one of the initial radicals formed in these systems. In both cases the radical is the one formed by removal of the nitro group from TNT. MNDO and MINDO/3 results indicate that removal of a nitro group from 1-nitropropene, used as a model system for TNT, is likely. Comparisons of the theoretical activation energy and the deuterium kinetic isotope effect for this step are in excellent agreement with measured values for these quantities early in the TNT decomposition. The nitro group removal is apparently facilitated by interaction with a second molecule in the system (HMB in the binary system or another TNT in the pure TNT system), which weakens the C-NO2 bond either by transferring a hydrogen atom or forming a charge-transfer complex. Other potential first steps in the mechanism have been investigated theoretically. Author (GRA)

N81-27299# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
RDX/HMX PLANT DESIGN Final Report
James D. Turner May 1981 26 p
(AD-A099536; AD-E400613; ARLCD-TR-80035) Avail: NTIS HC A03/MF A01 CSCL 05/5

There is presently only one domestic facility for production of RDX and HMX. In order to increase RDX/HMX production capability as well as to alleviate dependence on a sole source supply, the initial phase of design for an RDX/HMX Expansion Facility was conducted. The proposed RDX/HMX Expansion Facility at Holston Army Ammunition Plant (HAAP), Kingsport, Tennessee, called Plant X, consisted of two explosives manufacturing lines producing the end products Composition B, Composition A-5, and Octol 75/25, as well as raw material preparation and spent acid recovery facilities. GRA

N81-27300# Oregon State Univ., Corvallis. Dept. of Civil Engineering.
BACTERIAL TOXICITY AND METABOLISM OF THREE HYDRAZINE FUELS Final Report, 10 Jan. 1978 - 15 Aug. 1979
Donald A. Kane and Kenneth J. Williamson Tyndall AFB, Fla. Air Force Engineering and Sciences Center Sep. 1980 118 p refs
(Contract F08637-78-M-0066; AF Proj. 2103)
(AD-A099514; AFESC/ESL-TR-80-49) Avail: NTIS HC A06/MF A01 CSCL 06/20

This research sought to determine the toxicity of hydrazine (H), monomethyl hydrazine (MMH), and unsymmetrical dimethyl hydrazine (UDMH) to four enriched bacterial cultures: Nitrobacter, Nitrosomonas - Nitrobacter, anaerobic bacteria, and denitrifying bacteria. In addition, the metabolism of hydrazine by Nitrosomonas - Nitrobacter was examined. The toxicity studies used batch bioassay methods with response measured in terms of substrate metabolism rates. Results showed that hydrazine produced a 50% reduction in metabolism rate for Nitrobacter, Nitrosomonas Nitrobacker, anaerobic bacteria and denitrifying bacteria at concentrations of about 15, 165, 100 and 100 milligram per liter, respectively; monomethyl hydrazine at 15, -1, 75 and 10 milligram per liter, respectively, and UDMH at 1800, 35, 2300, and 12,500 milligram per liter, respectively. It was concluded that spills of these three fuels could be expected to seriously disrupt the natural bacterial balance in the aquatic environment. In addition, use of biological waste treatment for detoxification of these three fuels is not recommended. GRA

N81-27301# Politecnico di Milano (Italy). 1st. di Macchine.
THE DYNAMICS OF SOLID PROPELLANT COMBUSTION Final Technical Report, Nov. 1977 - Dec. 1980
Luigi DeLuca, Aldo Coghe, and Adolfo Reggiori 31 Dec. 1980 254 p refs
(Grant DA-ERO-78-G-029; DA Proj. 1T1-61102-BH-57)
(AD-A100043) Avail: NTIS HC A12/MF A01 CSCL 21/9

A nonlinear stability analysis of solid rocket propellant burning was carried out, within the framework of a thermal theory for thin (quasi-steady gas phase) heterogeneous flames. This required an integral method in reducing the partial differential equation for the condensed phase heat conduction to an approximate ordinary differential equation. A nonlinear algebraic function, called static restoring function, was found that contains all basic properties of equilibrium and stability of burning solid propellants. This function depends on the nature of the solid propellant (including its flame) and the operating conditions. Analysis of the static restoring function reveals the existence of lower and upper burning stabilities. Nonlinear static and dynamic burning stability boundaries were determined and stability properties of several unsteady flame models were compared. Domains of stationary reacting solutions, damped oscillatory burning, self-sustained oscillatory burning, non sustained burning were singled out. Pressure deflagration limit was evaluated. Validity

and plausible extensions of this theory are discussed. Most of the analytical predictions were verified by computer simulated burning tests. Experimental results obtained in shock tube apparatus, depressurization strand burner, laser doppler velocimetry rig are presented. Author (GRA)

N81-27302# New Mexico Inst. of Mining and Technology, Socorro. Dept. of Metallurgical and Materials Engineering.

PILOT PLANT FOR OIL-WATER EMULSION CLEANING OF PULVERIZED COAL Final Report, 1 Feb. 1980 - 31 Jan. 1981

G. Purcell 1981 30 p refs

(NP-25270) Avail: NTIS HC A03/MF A01

Emulsion technology (frequently referred to as spherical or oil agglomeration) was applied to some New Mexico steam coals. The oil agglomeration process is technically able to clean different New Mexico coals of very fine particle sizes. Combustible recoveries of around 90 percent and moisture contents well under 20 percent are obtained under the proper conditions. Even coal containing extremely high amounts of ash material are successfully cleaned with appreciable improvements in calorific value. Increasing oil addition increases recovery and agglomerate diameter and reduces ash content, retained moisture and inversion time. Approximately 20 percent total oil addition seems to strike a balance between low ash content, low moisture content, and high combustible recovery on the one hand and oil consumption on the other. DOE

N81-27303# Exxon Research and Engineering Co., Florham Park, N.J.

EDS COAL-LIQUEFACTION PROCESS DEVELOPMENT. PHASE 5: EDS COMMERCIAL PLANT STUDY DESIGN UPDATE, OFFSITE DESIGN BASIS-WYOMING COAL CASE

Jan. 1981 83 p refs

(Contract DE-AB01-77ET-10069)

(FE-2893-60) Avail: NTIS HC A05/MF A01

The development of the Wyoming Coal Case as a sensitivity to locating a commercial Exxon donor solvent plant in a northeast Wyoming location using the once through liquefaction mode is discussed. Operating conditions in liquefaction are 840 F, 60 minutes nominal residence time at a solvent to coal ratio of 1.6/1. The Wyoming Coal Case utilizes partial oxidation of about one half of the vacuum pipestill bottoms for hydrogen generation and flexicoking of the remaining bottoms to make low Btu gas for use as plant fuel. The methane/ethane product will be sold as high Btu gas (HBG). The offsite design effort is concentrated on the water, fuel, steam, and power systems and the wastewater treating facilities, and product shipping facilities. DOE

N81-27304# Exxon Research and Engineering Co., Florham Park, N.J.

EDS COAL-LIQUEFACTION PROCESS DEVELOPMENT. PHASE 5: EDS COMMERCIAL PLANT STUDY DESIGN UPDATE, ILLINOIS COAL. EXECUTIVE SUMMARY

Feb. 1981 27 p refs

(Contract DE-AB01-77ET-10069)

(FE-2893-61-Summ) Avail: NTIS HC A03/MF A01

The conceptual, or study design of an Exxon Donor Solvent (EDS) Coal Liquefaction Commercial Plant feeding Illinois No. 6 bituminous coal is presented. The EDS process directly converts coal to a range of clean hydrocarbon products. This is accomplished by contacting the coal with hydrogen in the presence of a hydrogenated solvent at about 840 F and 2000 psi. The technical and economic issues which might be faced if an EDS commercial sized plant were to be designed on Illinois coal are explored. DOE

N81-27305# Catalytic, Inc., Wilsonville, Ala.

SOLVENT REFINED COAL (SRC) PROCESS OPERATION OF SOLVENT REFINED COAL PILOT PLANT, WILSONVILLE, ALABAMA Quarterly Technical Progress Report, Jan. - Mar. 1980

Feb. 1981 142 p refs

(Contract DE-AC01-76ET-10154)

(FE-2270-72) Avail: NTIS HC A07/MF A01

Two coals from the Kentucky 9 seam (Lafayette mine and Dotiki mine) were processed. Hydrogen consumption, coal conversion, and SRC yield were comparable when these coals were tested under similar conditions. Process solvent quality improved after the feed was switched from Lafayette to Dotiki coal. A vertical leaf filter was used for solids separation during most of the Lafayette coal operations. Using solution annealed screens in the vertical leaf filter has eliminated the corrosion related screen failures previously encountered. Cresol-insoluble material was very low, but ash in the filtered SRC product consistently exceeded the 0.16 wt percent specification. The high ash SRC product appears to have resulted from the presence of sodium carbonate, which was added to the coal slurry to prevent corrosion in the solvent recovery system. Recovery of SRC in the CSD unit ranged from 78 to 82 wt percent. Deashing solvent losses averaged 4.9 wt percent of the CSD feed. DOE

N81-27306# Catalytic, Inc., Wilsonville, Ala.

SOLVENT REFINED COAL (SRC) PROCESS OPERATION OF SOLVENT REFINED COAL PILOT PLANT, WILSONVILLE, ALABAMA Quarterly Technical Progress Report, Apr. - Jun. 1980

Mar. 1981 149 p refs

(Contract DE-AC01-76-ET-10154)

(FE-2270-74) Avail: NTIS HC A07/MF A01

The operating conditions and test results obtained at the six-ton-per-day Solvent Refined Coal (SRC) pilot plant in Wilsonville, Alabama are summarized. The objectives of operations were to determine the effect of: high pressure separator operation; changes to vacuum column operating temperature; light SRC addition; and chlorine content of coal on corrosion. DOE

N81-27307# California Univ., Livermore. Lawrence Livermore Lab.

DYNAMIC MECHANICAL AND MOLECULAR WEIGHT MEASUREMENTS ON POLYMER BONDED EXPLOSIVES FROM THERMALLY ACCELERATED AGING TESTS. 1: FLUOROPOLYMER BINDERS

D. Mark Hoffman and Leonard E. Caley 1981 13 p refs Presented at the Am. Chem. Soc. Symp., Atlanta, 30 Mar. - 3 Apr. 1981 2 Vol.

(Contract W-7405-eng-48)

(UCRL-85120-Vol-1; CONF-810308-6) Avail: NTIS HC A02/MF A01

The dynamic mechanical properties and molecular weight distribution of two polymer bonded explosives, LX-10-1 and PBX-9502, maintained at 23, 60, and 74 C for 3 years were studied. LX-10-1 is 94.5 percent 1,3,5,7-tetranitro-1,3,5,7-tetraazacyclooctane explosive bonded together with 5.5 percent Vitron A fluoropolymer. PBX-9502 is 95 percent triaminotrinitrobenzene explosive bonded with 5 percent Kel-F-800 fluoropolymer. There are two mechanical relaxations in the LX-10-1 in the military temperature range. The relaxation at -10 C is associated with the glass transition temperature of the Viton A binder. A second weak relaxation occurs at about 30 C in all LX-10-1 samples tested. This relaxation is probably associated wth small amounts of crystallinity in the binder although this was not demonstrated. There is a slight increase in modulus of the LX-10-1 with accelerated aging temperature. Changes in the dynamic mechanical properties of PBX-9502 are ascribed to crystallization of the chlorotrifluoroethylene component of the Kel-F-800 binder. DOE

N81-27308# California Univ., Livermore. Lawrence Livermore Lab.

DYNAMIC MECHANICAL AND MOLECULAR WEIGHT MEASUREMENTS ON POLYMER BONDED EXPLOSIVES FROM THERMALLY ACCELERATED AGING TESTS. 2: POLYESTERURETHANE BINDER

D. Mark Hoffman and Leonard E. Caley 1981 10 p refs Presented at the Am. Chem. Soc. Symp., Atlanta, 30 Mar. - 3 Apr. 1981 2 Vol.

(Contract W-7405-eng-48)

(UCRL-85120-Vol-2; CONF-810308-4) Avail: NTIS HC A02/MF A01

The molecular weight distribution and dynamic mechanical properties of an experimental polymer bonded explosive, X-0282, maintaind at 23, 60, and 74 C for 3.75 y were examined. X-0282 is 95.5 percent 1,3,5,7-tetranitro-1,3,5,7-tetraazacyclooctane explosive and 4.5 percent Estane 5703, a segmented

poly(ester-urethane). Two mechanical relaxations at about -24 and 42 C were found in the X-0282 aged at room temperature for 3.75 years. A third relaxation at about 85 C was found in X-0282 aged at 60 and 74 C. The relaxation at -24 C is associated with the soft segment glass transition of the binder. The relaxation at 42 C is associated with the soft segment melting and may also contain a component due to the hard segment glass transition. The relaxation at 85 C is probably associated with improved soft segment crystallite perfection. The molecular weight of the poly(ester-urethane) binder decreased significatly with increasing accelerated aging temperature. DOE

N81-27309# Colorado State Univ., Fort Collins.
EVALUATION OF METHANE PRODUCTION FROM WET STILLAGE AND THE NUTRITIONAL VALUE OF THE RESIDUE Final Report
G. M. Ward and Vince Murphy Jan. 1981 35 p refs Sponsored by Midwest Research Inst.
(Contracts DE-AC02-77CH-00178; EG-77-01-4042)
(SERI/TR-09076-1) Avail: NTIS HC A03/MF A01

Wet stillage was obtained from a farm still that used both corn and milo as feedstocks. The mash was passed through the still and the stillage was run through a screw press which resulted in two streams: a solid fraction containing about 38 percent solids and a thin stillage fraction containing 5 percent silo. Methane production was evaluated in a laboratory fermenter of 1-L capacity for samples of the solid fraction and for one sample of the thin stillage. The original stillage and the residue remaining after methane digestion were evaluated as livestock feed by means of the standard in vitro dry matter digetibility method (IVDMD). Methane represented 50 to 70 percent of the gas production. Methane production ranged from 300 to 500 L/kg of solids after fermenting 22 to 24 days, and was essentially the same whether crop or milo was the feedstock. One sample of thin stillage performed similar to the solid fraction on dry matter basis. The IVDMD of the original stillage averaged 53 percent, while the residue after methane digestion was only 12 percent. DOE

N81-27310# Sandia Labs., Albuquerque, N. Mex. Initiating and Pyrotechnic Components Div.
STUDY OF FACTORS WHICH INFLUENCE THE SHOCK INITIATION SENSITIVITY OF HEXANITROSTILBENE (HNS)
Alfred C. Schwarz Mar. 1981 23 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-2372) Avail: NTIS HC A02/MF A01

An experimental program was conducted to study factors which influence the shock initiation sensitivity of hexanitrostilbene (HNS). The six factors evaluated were: (1) powder morphology, (2) sample density, (3) test temperature, (4) sample length, (5) diameter of the impacting flyer, and (6) duration of the input stimulus. In addition, the effect of pressure duration, tau, was assessed on the initiation sensitivity of an extrudable explosive (LX-13) and of hexanitroazobenzene (HNAB) for comparison with that of superfine hexanitrostilbene (HNS-SF). Flyer velocity determined impact pressure, P (3 to 20 GPa), and flyer thickness the shock duration, tau (0.010 to 0.150 (SIGMA)s), the pulse shape being rectangular. Powder morphology was the most significant factor to influence the initiation sensitivity of HNS; with 0.035-(SIGMA)s pulses the smallest particle sized HNS had a threshold pressure for initiation which was 50% of that required for the coarser HNS-II. Other factors which lowered the threshold pressure were: lower sample density, elevated test temperature, and larger diameter flyers. DOE

N81-27311# Research Inst. of Colorado, Fort Collins.
HYDROGEN AND METHANE SYNTHESIS THROUGH RADIATION CATALYSIS Final Report, 1 Jun. 1979 - 30 Jun. 1980
Joel DuBow Sep. 1980 44 p refs
(Contract DE-AC02-77ER-04258)
(DOE/ER-04258/T1) Avail: NTIS HC A03/MF A01

The goal of this research was to evaluate the potential for using reactor wastes to synthesize useful products in quasi-photochemical configuration. It was found that semiconductor oxides act as heterogenous catalysts for the formation of H2 in aqueous media under Co-60 irradiation. The principle of a gamma ray solar cell was demonstrated experimentally. Experiments with ultraviolet irradiated TiO2 and ZnO grains demonstrated that both H2 and H2O2 were formed. These results were rationalized by energy band diagram representations and by applying principles of semiconductor photoelectrochemistry. The concept of gamma ray assisted desulfurization of coal through radiological degradation and heterogenous catalysis was experimentally demonstrated. The proof of concept experiments provide the basis for further fundamental and applied investigations, particularly in a potentially efficient system with a fresh source and 1.5 m path length. DOE

N81-27312# Worcester Polytechnic Inst., Mass.
KINETICS AND MECHANISMS OF CATALYTIC HYDROLIQUEFACTION AND HYDROGASIFICATION OF LIGNITE Final Technical Report
Alvin H. Weiss, Wilmer L. Kranich, Kemal Geureuz, Athanasios Foutsitzas, Charles A. Dyke, and Paolo Rambelli 1981 129 p refs
(Contract DE-AS22-77ET-10618)
(DOE/ET-10618/T2) Avail: NTIS HC A07/MF A01

A high pressure, continuous, stirred-tank reactor system was constructed for the study of the catalytic liquefaction of North Dakota lignite slurried in anthracene oil. The conversion of lignite using a cobalt-molybdenum on alumina catalyst and the distribution of products as preasphaltenes, asphaltenes, oil and gases studied at the following conditions: temperature, 375 to 4400 C; pressure, 1000 to 1600 psig; agitator speed, 800 to 1500 rpm; catalyst concentration, 0 to 10% (based on lignite); initial lignite concentration, 5 to 30%; and space time, 16 to 52 minutes. In the presence of catalyst, the oil yield was increased, even under conditions where the catalyst did not affect overall lignite conversion. Under the most favorable conditions the oil yield was little better than that obtained by Cronauer in the uncatalyzed hydroliquefaction of subbituminous coal at similar temperature and pressure. DOE

N81-27313# Wisconsin Univ. - Madison.
USE OF ALCOHOL IN FARMING APPLICATIONS: ALTERNATIVE FUELS UTILIZATION PROGRAM
G. L. Borman Nov. 1980 26 p
(Contracts DE-AC02-79CS-55025; DE-AC05-79CS-56051)
(DOE/CE-50025/1) Avail: NTIS HC A03/MF A01

The use of alcohol with diesel fuel was investigated as a means of extending diesel fuel supplies. The ability to use ethanol in diesel powered farm equipment could provide the means for increasing the near term fuels self sufficiency of the American farmer. In the longer term, the potential availability of methanol (from coal) in large quantities could serve to further decrease the dependency on diesel fuel. This document gives two separate overviews of the use of alcohols in farm equipment. Part one of this document compares alcohol with No. 1 and No. 2 diesel fuels and describes several techniques for using alcohol in farm diesel. Part two of this document discusses the use of aqueous ethanol in diesel engines, spark ignition engines and provides some information on safety and fuel handling of both methanol and ethanol. DOE

N81-27314# Mitre Corp., McLean, Va. Metrek Div.
IMPACT OF DEVELOPING TECHNOLOGY ON INDIRECT LIQUEFACTION
David Gray, Milton Lytton, Martin Neuworth, and Glen Tomlinson Nov. 1980 252 p refs
(Contracts DE-AC01-77ET-10280; EF-77-C-01-2783)
(DOE/ET-10280/T2; MTR-80W326) Avail: NTIS HC A12/MF A01

The status of commercial technology for indirect liquefaction, as exemplified by SASOL facilities in South Africa, is reviewed. The impact of substituting more advanced gasifiers and synthesis systems is investigated. Slagging BGC/Lurgi, Texaco and Shell-Koppers gasifiers were substituted for the Dry Ash Lurgi units used at SASOL. SASOL SYNTHOL synthesis units were replaced by slurry phase Fischer-Tropsch units employing technology pioneered by Kolbel. The advanced systems were found to have a highly favorable impact on plant efficiency, product distribution and gasoline cost. DOE

N81-27315# Los Alamos Scientific Lab., N. Mex.
LASER SIMULATION OF SOLAR PYROLYSIS AND GASIFICATION USING STATIC COAL SAMPLES
Willard H. Beattie Apr. 1981 22 p refs
(Contract W-7405-eng-36)
(LA-8617) Avail: NTIS HC A02/MF A01

Coal gasification by rapid radiant heating has been investigated in a controlled laboratory environment. The goals of this research were to test the feasibility of solar-driven coal gasification and to understand the conditions that control product gas yields. A technique using a CO2 laser was developed for small-scale simulation of concentrated sunlight. The effects of parameters such as radiant flux, heating time, and pressure on coal pyrolysis and on the reaction between char and CO2 were investigated. Good yields of medium Btu gas may be produced by pyrolysis of subbituminous coal and gasification of the resultant char in a solar flux of a least 250 W/cm(2). The data reported here will be useful in the design of any larger scale engineering tests of these concepts. DOE

N81-27316# Development Planning and Research Associates, Inc., Manhattan, Kans.
FEASIBILITY OF CONVERTING A SUGAR BEET PLANT TO FUEL ETHANOL PRODUCTION
Geneva S. Hammaker, Harry B. Pfost, Milton L. David, and Mary Lou Marino Apr. 1981 228 p refs
(Contract DE-AC02-80CS-80010)
(DOE/CS-83010/T1) Avail: NTIS HC A11/MF A01

This study was performed to assess the feasibility of producing fuel ethanol from sugar beets. The potential feedstocks assessed included sugar beets, corn, hybrid beets, and potatoes. Markets were assessed for ethanol and fermentation by products saleability. Investment and operating costs were determined for each prospective plant. Plants were evaluated using a discounted cash flow technique to obtain data on full production costs. Environmental, health, safety, and socio-economic aspects of potential facilities were examined. Three consulting engineering firms and 3 engineering construction firms are considered capable of providing the desired turn key engineering design and construction services. It was concluded that the project is technically feasible. DOE

N81-27317# Scottsbluff-Gering Payroll Development Foundation, Inc., Scottsbluff, Nebr.
STUDY OF THE PRODUCTION OF ETHANOL FROM SUGAR BEETS FOR USE AS A MOTOR FUEL Final Report, 1 Feb. 1980 - 30 Apr. 1981
Herschel W. Baird 27 Apr. 1981 41 p
(Contract DE-AC02-80CS-83010)
(DOE/CS-83010-1) Avail: NTIS HC A03/MF A01

The decision was made to use Great Western Sugar Company's plant at Mitchell as the example plant. This plant was selected primarily on the basis of its independence from other plants and the availability of relatively nearby beet acreage. The potential feedstock assessed included sugar beets, corn, hybrid beets, and potatoes. Markets were assessed for ethanol and fermentation by products saleability. Investment and operating costs were determined for each prospective plant. Plants were evaluated using a discounted cash flow technique to obtain data on full production costs. Environmental, health, safety, and socio-economic aspects of potential facilities were examined. Three consulting engineering firms and three engineering construction firms are considered capable of providing the desired turn key engineering design and construction services. It was concluded that the project is technically feasible. DOE

N81-27318# Sandia Labs., Albuquerque, N. Mex. Explosive Materials Div.
CHARACTERIZATION AND PERFORMANCE OF THIRTEEN BORON/CALCIUM CHROMATE PYROTECHNIC BLENDS
J. W. Rogers, Jr. Mar. 1981 84 p refs
(Contract DE-AC04-76DP-00789)
(SAND-81-0411) Avail: NTIS HC A05/MF A01

A study of special 20/80 wt percent B-CaCrO4 pyrotechnic blends designed to determine which properties of the powders are important in determining pyrotechnic performance is presented. The effects of particle size, surface area, magnesium impurity, and surface properties on burn rate, hot wire and electrostatic ignition sensitivity and compaction behavior were determined using a variety of techniques. The data indicate that small boron particle sizes (high boron surface areas) and/or better fuel-oxidizer coating tend to increase burn rate, lower hot wire ignition energies, and increase electrostatic ignition (spark) sensitivity. On the other hand, larger CaCrO4 particle sizes (for a constant boron particle size) tend to increase hot wire and electrostatic ignition sensitivity while decreasing the burn rate. No correlation between magnesium impurity and any performance characteristic was observed, though calorific output was not determined. Backup analytical work, moisture uptake, and drying of the blends are discussed and a short section on compatability is included. DOE

N81-27319# Sandia Labs., Albuquerque, N. Mex. Geo-Energy Technology Dept.
CATALYTIC EFFECTS IN COAL GASIFICATION Annual Report
T. D. Padrick Apr. 1981 29 p refs
(Contract DE-AC04-76DP-00789)
(SAND-81-0282) Avail: NTIS HC A03/MF A01

The effects of mineral matter on the devolatilization of coal and subsequent char gasification are discussed. A basis set of five Eastern bituminous coals whose mineral matter content ranged from < 5 percent to > 20 percent, but which are similar in rank and petrographic analysis was selected. The gasification rates were measured in one atmosphere of H2 at 6000C, 8000C, and 10000C. No correlation was found between gasification rate and mineral matter or petrographic analysis, but a correlation was found between the gasification rates and the rank or structure of the coal. It was found that pyrite increased the gasification rates of a low-ash coal and a demineralized high-ash coal. Product gas analysis showed that the addition of pyrite primarily increased the production of CO and CH4. DOE

N81-27320# Los Alamos Scientific Lab., N. Mex.
DEFLAGRATION-TO-DETONATION TRANSITION IN SMALL-DIAMETER COLUMNS OF PETN
Robert H. Dinegar Mar. 1981 6 p refs
(Contract W-7405-eng-36)
(LA-8696) Avail: NTIS HC A02/MF A01

The transition from deflagration to detonation in pure pentaerythritol tetranitrate (PETN) confined in small-diameter (2-mm) steel columns of three lengths (6.4, 9.6, and 12.8 mm) was examined. These relatively low density pressings of PETN were deflagrated by donor charges of high-density that had been ignited by a hot wire. A dent produced in an aluminum witness block was the criterion for determining detonation. The transition from burning to detonation occurred in pressings of all three lengths. Detonation velocities sufficient to initiate high-density PETN booster pellets were reached in the 9.6 and 12.8 mm pressings. DOE

N81-27321# Research Inst. of National Defence, Stockholm (Sweden).
FUEL-RICH PROPELLANTS WITH AMMONIUM PERCHLORATE AS OXIDIZER AND MIXTURES OF HTPB AND POLYSTYRENE AS FUEL
Torsten Liljegren Feb. 1981 24 p refs In SWEDISH; ENGLISH summary
(FOA-C-20395-D1) Avail: NTIS HC A02/MF A01

Propellants with hydroxy terminated polybutadiene (HTPB) and high contents of polystyrene (PS) as fuel were studied by test firing in rocket motors. The polystyrene is in granular form with the particle size 100 to 300 microns. The densities and therefore also the density specific impulses of these propellants are higher than for the corresponding pure HTPB-propellants. They have also higher burning rates, provided that fine ammonium perchlorate (AP) and an efficient burning catalyst (alkylferrocene) are used and that the ratio PS:HTPB is larger than 1:1. Especially high burning rates are achieved with ultrafine ammonium perchlorate: 30mm/s at 10 MPa with 30% AP. HTPB-propellants with polystyrene give generally less soot residues than pure HTPB-propellants. Author (ESA)

N81-27322# PEDCo-Environmental, Inc., Cincinnati, Ohio.
SUMMARY OF COAL-BASED SYNTHETIC FUEL INITIATIVES Final Report, Jun. - Nov. 1980
J. Carvitti, M. Szabo, and W. Kemner Feb. 1981 45 p refs

(Contract EPA-68-02-3173)
(PB81-168742; PN-3450-21; EPA-600/7-81-023;
EPA-600-13) Avail: NTIS HC A03/MF A01 CSCL 21D

The status of demonstration and commercial-scale plants for the production of coal-based synthetic fuels through quasification and liquefaction is investigated. Data on the scope of this emerging industry, funding sources, products, and costs were obtained by reviewing current literature and contacting the primary vendors or licensors of the processes found. Of the 88 synthetic fuel projects identified, 66 represent gasification processes (29 for the production of low-Btu gas and 37 for the production of high-Btu gas) and 22 represent liquefaction processes. Tabulations show sponsors, production capacity, estimated production costs, scale, type of coal involved, feed rate of coal, capital cost, and operating and maintenance costs. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N81-27323* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
STRUCTURAL MEMBERS, METHOD AND APPARATUS Patent
Jack A. Kinzler, inventor (to NASA) Issued 9 Dec. 1980 21 p Filed 4 Apr. 1978 Supersedes N78-22146 (16 - 13, p 1672)
(NASA-Case-MSC-16217-1; US-Patent-4,237,662;
US-Patent-Appl-SN-893383; US-Patent-Class-52-108;
US-Patent-Class-52-745) Avail: US Patent and Trademark Office CSCL 13B

A method and apparatus for fabricating a structural member such as truss from flexible sheet material in compacted form are disclosed. A number of generally tubular columns are progressively formed from the sheet material and deployed generally parallel to one another. Adjacent pairs of the columns are interconnected by respective side members, each of which is comprised of a strip of the sheet material. The sheet material is fastened together by self-attaching fasteners integrally formed from the sheet material of the columns and side members themselves.
Official Gazette of the U.S. Patent and Trademark Office

N81-27324* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TELESCOPING COLUMNS Patent
John T. Mazur, inventor (to NASA) (Harris Corp., Melbourne, Fla.) Issued 16 Dec. 1980 8 p Filed 29 Sep. 1978 Supersedes N78-33446 (16 - 24, p 3222) Sponsored by NASA
(NASA-Case-LAR-12195-1; US-Patent-4,238,911;
US-Patent-Appl-SN-946991; US-Patent-Class-52-111;
US-Patent-Class-52-632; US-Patent-Class-182-62.5;
US-Patent-Class-212-267) Avail: US Patent and Trademark Office CSCL 13B

An extendable column is described which consists of several axially elongated rigid structural sections nested within one another. Each section includes a number of rotatably attached screws running along its length. The next inner section includes threaded lugs oriented to threadingly engage the screws. The column is extended or retracted upon rotation of the screws. The screws of each section are selectively rotated by a motor and an engagement mechanism.
Official Gazette of the U.S. Patent and Trademark Office

N81-27325 British Library Lending Div., Boston Spa (England).
PRINTING INKS AND COLOURS
H. Bretler Feb. 1981 13 p Transl. into ENGLISH from Kriminalistik (West Germany), no. 5, 1979 p 222-225
(BLL-RTS-12321) Avail: British Library Lending Div., Boston Spa, England

Possibilities of incorporating elements of safeguard into valuable documents by using inks and colors specially developed for this purpose are presented. These include: (1) copperplate printing; (2) dry offset printing; (3) wet offset printing; and (4) letterpress printing. S.F.

N81-27326 British Library Lending Div., Boston Spa (England).
ELECTROPHOTOGRAPHIC COLOUR PROOF-PRINTING PROCESS AND APPARATUS FOR PRINTING TECHNOLOGY
R. H. Epping Nov. 1980 14 p Transl. into ENGLISH of German Patent no. 2734631, 2 Aug. 1979 12 p
(BLL-RTS-12440) Avail: British Library Lending Div., Boston Spa, England

An electrographic color proof printing process is described. A photoconductor is subjected to an electrostatic charge in which the preparation of the electrostatic charge image follows in the form of an accumulation of unipolar, oppositely charged pigments of a component color on the charge image. With the use of an electrocatic field, a transference of the dye toner distribution from the photoconductor to printing paper takes place followed by fixing of corresponding dye toner distribution on the printing paper. The process stages are repeated for each of the other component colors. With half tone copies the photoconductor is subjected to an exposure of the copy and an imaging of the screen structure in one stage of the process. E.A.K.

N81-27327*# Sperry Rand Corp., New York.
GSFC PREFERRED PARTS LIST PPL-15
John W. Adolphsen, ed. Oct. 1980 88 p Sponsored by NASA
(NASA-CR-164427) Avail: NTIS HC A05/MF A01 CSCL 13I

A listing is presented of preferred electronic parts, part upgrading procedures, part derating guidelines, and part screening procedures to be used in the selection, procurement, and application of parts for Goddard Space Flight Center space systems and ground support equipment. M.G.

N81-27328*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
REFRIGERATOR MODULE, SYSTEM AND PROCESS Patent Application
Walter F. Brooks and Peter Kittel, inventors (to NASA) (National Academy of Sciences - National Research Council, Washington, D.C.) Filed 24 Jun. 1981 15 p
(NASA-Case-ARC-11263-1; US-Patent-Appl-SN-276750) Avail: NTIS HC A02/MF A01 CSCL 13I

A hermetically sealed, valve-free assembly containing helium 3 or other refrigerant is used in a refrigerator module including a refrigerant evaporator, a refrigerant condenser, and a refrigerant adsorption pump serially connected but thermally isolated, so that the refrigerant may pass from one element to another. A heater is provided for the adsorption pump. During operation, the adsorbing unit is heated to drive adsorbed refrigerant vapor to the condenser. Refrigeration occurs when the refrigerant is evaporated in the evaporator and simultaneously adsorbed in the adsorbing unit to decrease refrigerant vapor pressure. When connected to the cold plate of a helium 4 or other refrigerant cryostat, the resulting multistage refrigeration system gives improved and simplified operation in practice. NASA

N81-27329# Office of the Deputy Secretary of Defense, Washington, D. C.
DOD METRIC SEMINAR/WORKSHOP (1980) Final Report
23 Apr. 1981 185 p refs Workshop held at Washington, D.C., 18-20 Nov. 1980
(AD-A099780) Avail: NTIS HC A09/MF A01 CSCL 14/2

Mid-level DoD managers met to discuss defense policies, plans, problem areas, and solutions needed to implement the provisions of the U.S. Metric Act (P.L. 94-168) and DoD Directive 4120.18 Metric System of Measurement. The work proceedings presented include speeches and presentations, minutes, workshop action items, recommendations, and list of attendees. GRA

N81-27330# Oak Ridge Gaseous Diffusion Plant, Tenn. Orgop Industrial Hygiene Dept.
CONTROL OF AIRBORNE NICKEL WELDING FUMES BY MEANS OF A VERTICAL LAMINAR AIR FLOW SYSTEM
T. C. Helms 8 Dec. 1980 16 p
(Contract W-7405-eng-26)
(K/RA-102) Avail: NTIS HC A02/MF A01

The effectiveness of a clean room facility with laminar air flow in the control of nickel fumes is evaluated. The fumes are

released from metal inert gas (MIG) and shielded metal arc (SMA) welding operations performed on mild steel using nickel filler materials. The laminar flow clean room approach to controlling welding fumes can be successful in certain small table top welding operations. However, almost any interferences that obstruct the downward airflow results in eddy currents and subsequent buildup of fumes by entrapment. Airflow patterns differ significantly when comparing table top operations to welding on large cylindrical and/or doughnut shaped items. After fifteen days of sampling, airflow was reduced to 140-150 feet per maximum. Additional prefiltering units would be required for efficient operation of a laminar air flow clean room in an actual shop situation. DOE

N81-27331# Oak Ridge Y-12 Plant, Tenn. Instrumentation and Characterization Dept.

RESIDUAL CONTAMINANTS IN DYE-PENETRANT TESTING

J. F. McLaughlin, P. G. Schneider, and M. H. Eager 13 Apr. 1981 23 p refs

(Contract W-7405-eng-26)

(Y-2230) Avail: NTIS HC A02/MF A01

Components of the dye penetrant testing process for thin walled cans were characterized by microanalytical methods. Particulate material of a size range small enough to plug small leaks was found. Testing of simulated leaks before and after dye penetrant examination showed that the dye penetrant testing had a high probability of plugging leaks < 0.0001 atm cu cm of helium in size. DOE

N81-27332# Sydney Univ. (Australia). Civil Engineering Labs.

THE BEHAVIOUR OF FOOTINGS RESTING ON A NON-HOMOGENEOUS SOIL MASS WITH A CRUST. PART 1: STRIP FOOTING

R. K. Rowe and J. R. Booker Sep. 1980 56 p refs

(PB81-150732; R-374-Pt-1) Avail: NTIS HC A04/MF A01 CSCL 13B

A finite layer method developed to analyze the behavior of footings on a nonhomogeneous soil is outlined. The elastic response of strip footings for a wide range of soil profiles involving a weathered crust overlying a main deposit is investigated. The effect of layer depth, crust depth, and the rate of variation of stiffness within the crust and the underlying soil are examined. The influence of this nonhomogeneity upon settlement profile, differential settlement, and consolidation settlement is discussed. GRA

N81-27333# Sydney Univ. (Australia).

THE BEHAVIOUR OF FOOTINGS RESTING ON A NON-HOMOGENEOUS SOIL MASS WITH A CRUST. PART 2: CIRCULAR FOOTINGS

R. K. Rowe and J. R. Booker Sep. 1980 58 p refs

(PB81-150781; R-375-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 13B

The behavior of circular footings resting on a nonhomogeneous elastic soil with a crust was investigated. The stiffness of the crust is either constant or to decrease with depth while the stiffness of the underlying soil increases linearly with depth. The effect of layer depth, crust depth and the rate of variation of stiffness within the crust and the underlying soil, upon the settlement profile is considered. The behavior of circular footings is compared with that of strip footings and the relative importance of the crust and the underlying soil parameters is discussed. The influence of cross anisotropy upon footing response is examined and the effects of neglecting anisotropy are indicated for a number of soil profiles. GRA

N81-27334# Pennsylvania State Univ., University Park.

NONLINEAR VISCOELASTIC BEHAVIOR OF A COHESIVE SOIL UNDER UNIAXIAL LOADING CONDITIONS Final Technical Report

Saeed Rafie and M. G. Sharma Sep. 1980 98 p refs

(Grant NSF PFR-78-800379)

(PB81-165573; NSF/RA-800379) Avail: NTIS HC A05/MF A01 CSCL 08M

The nonlinear viscoelastic behavior of a cohesive soil under uniaxial loading conditions was studied. A constitutive relationship based upon a multiple integral representation was developed. The time dependent parameters of this relation (Kernal functions) were determined, performing uniaxial single-step creep tests on a specially developed test apparatus. The constitutive relationship was genearlized for multi-step loading, as well as dynamic sinusoidal loading conditions. It was shown that the behavior of the material for multi-step loading conditions can be predicted by the results of the single-step tests. In addition, the behavior of the soil under uniaxial compressive cyclic loading was studied, using an apparatus specially developed for that purpose. GRA

N81-27335# Sydney Univ. (Australia). Civil Engineering Labs.

THE BEHAVIOUR OF SINGLE AND MULTIPLE UNDERREAM ANCHORS IN A GIBSON SOIL

R. K. Rowe and J. R. Booker Sep. 1980 50 p refs

(PB81-150799; R-373) Avail: NTIS HC A03/MF A01 CSCL 13B

An accurate and economical technique for the analysis of buried footings and multiple underream anchors in a nonhomogeneous elastic soil is outlined. The behavior of both isolated underreams and multiple underream systems is examined. Consideration is given to the effect on anchor response of nonhomogeneity, anchor embediment, layer depth and Poisson's ratio as well as the number and spacing of underreams. The influence of anisotropy and anchor inclination are also discussed. GRA

N81-27336# Sydney Univ. (Australia). Civil Engineering Labs.

ANALYSIS OF FOUNDATIONS ON REINFORCED SOIL

B. S. Brown and H. G. Poulos Oct. 1980 25 p refs

(PB81-150740; R-377) Avail: NTIS HC A02/MF A01 CSCL 13B

A finite element model of reinforced earth is used to investigate the increase in bearing capacity and stiffness of a foundation due to the placement of reinforcement in the soil. The analysis is used to examine the effect of reinforcement on the load settlement behavior of a strip foundation founded on a c-theta soil. It is shown that the improvement in foundation performance depends on both the number of reinforcing layers and on the concentration (surface area per unit width of footing) of the reinforcement. The case of a footing on a reinforced soil mass overlying a cavity or a very soft zone is also analyzed, and the reinforced soil is shown to result in a significant improvement in footing performance. GRA

N81-27337# IIT Research Inst., Chicago, Ill. Fire and Safety Research Section.

DEVELOPMENT OF A FIRE IN A ROOM FROM IGNITION TO FULL ROOM INVOLVEMENT: RFIRES

R. Pape, T. E. Waterman, and T. V. Eichler Jan. 1981 186 p refs

(Grant NB79-SBCA-0068)

(PB81-166639; NBS-GCR-81-301) Avail: NTIS HC A09/MF A01 CSCL 13M

The computer code RFIRE, developed to predict the response of a room to the burning of items within it, is documented. The model considers a rectangular room with a single door or window opening to a large reservoir of clean air. Up to 10 rectangular, box-shaped fuel items are considered. Flow charts, input and output instructions, code listing, summary of physical equations, results of comparisons to experimental fires, sensitivity analyses, and probabilistic descriptions of fuel item burning rates are included. GRA

N81-27338# Lehigh Univ., Bethlehem, Pa.

FATIGUE BEHAVIOR OF FULL-SCALE WELDED BRIDGE ATTACHMENTS Final Report

J. W. Fisher, B. M. Barthelemy, D. R. Mertz, and J. A. Edinger Nov. 1980 57 p refs Sponsored in part by Federal Highway Administration

(PB81-161754; TRB/NCHRP/REP-227; ISBN-0-309-03033-1) Avail: NTIS HC A04/MF A01 CSCL 13M

Findings of an extensive laboratory evaluation of the fatigue behavior of welded steel bridge members are reported. The fatigue strength of beams with web and flange lateral attachment plates are examined. In addition to providing a more comprehensive data base for this type of detail, the influence of lateral bracing

members on the out-of-plane distortion of the lateral plates is explored. Work also was undertaken on the effectiveness of peening and gas tungsten arc remelting the fatigue-damaged connections and on the ability of drilled holes to arrest crack growth. GRA

N81-27339# Sydney Univ. (Australia). Civil Engineering Labs.

FINITE LAYER ANALYSIS OF NON-HOMOGENEOUS SOILS

R. K. Rowe and J. R. Booker Sep. 1980 40 p refs
(PB81-150823; R-372) Avail: NTIS HC A03/MF A01 CSCL 13B

A finite layer approach capable of analyzing both layered and continuously varying cross anisotropic elastic soil profiles is presented. The method of analysis is suited for soil deposits in which there is no variation in properties in the horizontal plane. The proposed technique provides an accurate and computationally more economical alternative to the use of the finite element method. The benefits of this approach are evident for three dimensional problems and for problems involving deep soil layers. The application of the theory is illustrated by analyzing the behavior of uniformly loaded strip and circular footings resting on a soil with homogeneous crust underlain by a main deposit whose stiffness increases linearly with depth. GRA

N81-27340# Sydney Univ. (Australia). Civil Engineering Labs.

THE ELASTIC RESPONSE OF MULTIPLE UNDERREAM ANCHORS

R. K. Rowe and J. R. Booker Jul. 1980 38 p refs
(PB81-150807; R-369; GEOT-1-79) Avail: NTIS HC A03/MF A01 CSCL 13B

A technique to analyze multiple underream anchor systems resting in an elastic was developed. The approach is analytical and involves only a fraction of the computation required for a finite element analysis. The effects of anchor deph and inclination to the soil surface, and the spacing and number of underreams upon the elastic response of anchor systems are considered. A simple, approximate method for estimating the response of multiple underream anchors is proposed. This approach uses several interaction charts, which can be used as a hand method quite general anchor systems to sufficient accuracy for most practical purposes. GRA

N81-27478*# Frequency and Time Systems, Inc., Danvers, Mass.

GOVERNMENT AND INDUSTRY INTERACTIONS IN THE DEVELOPMENT OF CLOCK TECHNOLOGY

Helmut Hellwig *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 253-274 refs (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 13H

N81-27480*# Hewlett-Packard Co., Santa Clara, Calif.

R AND D: TO FUND OR NOT TO FUND

Terry N. Osterdock *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 281-289 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 05A

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N81-27341* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

APPARATUS AND METHOD FOR DETERMINING THE POSITION OF A RADIANT ENERGY SOURCE Patent

Gustave J. Schaefer, inventor (to NASA) (Hughes Aircraft Co., Los Angeles) Issued 30 Jun. 1981 18 p Filed 24 Mar. 1977 Supersedes N77-20410 (15 - 11, p 1453) Sponsored by NASA
(NASA-Case-GSC-12147-1; US-Patent-4,276,553; US-Patent-Appl-SN-780873; US-Patent-Class-343-112R) Avail: US Patent and Trademark Office CSCL 20N

The position of a terrestrial RF source is determined from a geostationary, synchronous satellite by scanning the beam of a narrow beam width antenna in first and second orthogonal directions over a region including the source. The peak level of energy transduced by the antenna in each of the scanning directions is detected and correlated with the scanning position of the beam by feeding the output of a detector responsive to the transduced signal to an indicator of an X-Y recorder. The X and Y axes of the recorder are scanned in synchronism with the beam being respectively scanned in the first and second directions to form X and Y traces on which are indicated the detected peak position in each of the scanning directions. The source position is determined from an intersection of lines drawn parallel to the X and Y axes and including the detected peak position of each trace.

Official Gazette of the U.S. Patent and Trademark Office

N81-27342 British Library Lending Div., Boston Spa (England). Library and Information Services.

FLAT TELEVISION SCREENS, PART 1

A. Fischer Jul. 1980 28 p refs Transl. into ENGLISH from Nachrichtentech. A. (West Germany), v. 33, no. 2, 1980 p 80-88
(BLL-Trans-3832-(7737.47)-Pt-1) Avail: British Library Lending Div., Boston Spa, England

A liquid crystal or electroluminescence screen with thin film addressing is considered as an alternative to the conventional, highly developed electron beam picture tube. Flat picture plates address the individual picture points in the form of an X-Y matrix. Topics covered include: principles of matrix addressing; intermediate storage for each picture point; design of stepping switches; choice of materials for the thin film transistors; baking thin film transistors; production of the vapor-deposition masks; and microprocessor control of mask feed. Schematics are included. A.R.H.

N81-27343*# Ohio State Univ., Columbus. ElectroScience Lab.

AMPLITUDE AND ANGLE OF ARRIVAL MEASUREMENTS ON A 28.56 GHz EARTH-SPACE PATH

D. M. J. Devasirvatham and D. B. Hodge Mar. 1981 51 p refs
(Contract NASw-3393)
(NASA-CR-164533; ESL-TR-712759-4) Avail: NTIS HC A04/MF A01 CSCL 20N

The amplitude and angle of arrival measurements on an Earth-space path using the 28.56 GHz COMSTAR D3 satellite beacon are described. These measurements were made by the Ohio State University ElectroScience Laboratory during the period September 1978 to September 1979. Monthly, quarterly, and annual distributions of attenuation, angle of arrival, and variance of both these parameters are reported. During this period, fades exceeding 29 dB for .00% of the time and angle of arrival fluctuations exceeding .12 degrees for .01% of the time were observed. E.D.K.

N81-27344*# Ohio State Univ., Columbus. Dept. of Electrical Engineering.

A MICROCOMPUTER BASED DATA ACQUISITION SYSTEM AND EXPERIMENT CONTROLLER

Matthew W. Ganz Feb. 1981 128 p refs
(Contract NASw-3393)
(NASA-CR-164535; TR-712759-3; ESL-712759-3) Avail: NTIS HC A07/MF A01 CSCL 20N

A data acquisition system is described. The system monitors and records the signal strength of a radio beacon sent to Earth from a geosynchronous satellite. It acquires data from several devices such as a radar, a radiometer, and a rain gauge which monitor the meteorological conditions along the Earth space propagation path. The acquired data are stored in digital format on magnetic tape for analysis at the computer center. A detailed description of the design and operation of the system's various hardware components is given. Schematic diagrams, the theory

of operation, and normal operating procedures are presented. S.F.

N81-27345*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADIO FREQUENCY INTERFERENCE AT THE GEOSTATIONARY ORBIT Final Report
M. K. Sue 15 Jun. 1981 39 p refs
(Contract NAS7-100)
(NASA-CR-164531; JPL-Pub-81-34) Avail: NTIS HC A03/MF A01 CSCL 20N

Growing demands on the frequency spectrum have increased the possibility of radio frequency interference (RFI). Various approaches to obtain in orbit RFI data are compared; this comparision indicates that the most practical way to obtain RFI data for a desired orbit (such as a geostationary orbit) is through the extrapolation of in orbit RFI measurements by a low orbit satellite. It is concluded that a coherent RFI program that uses both experimental data and analytical predictions provides accurate RFI data at minimal cost. E.D.K.

N81-27346*# National Aeronautics and Space Administration, Washington, D. C.
FUNCTIONS OF CUMULATIVE DISTRIBUTION OF ATTENUATION DUE TO RAIN ON AN INTERVAL FROM 9.5 Km A TO 17.8 GHz
Francesco Fedi and Peirgiorgio Migliorini Jan. 1981 41 p refs Transl. into ENGLISH of "Funzioni di Distribuzione Cumulative Dellattenuazione Dovuta a Pioggia su una Tratta di 9.5 Km A e 17.8 GHz" Rept. RIF-1B2178, Rome, Dec. 1978 38 p Transl. by Scientific Translation Service, Santa Barbara, Calif. Orig. doc. prep. by Fondazione Ugo Bordoni
(Contract NASw-3198)
(NASA-TM-76591; RIF-1B2178) Avail: NTIS HC A03/MF A01 CSCL 20N

Measurement results of attenuation due to rain are reported. Cumulative distribution functions of the attenuation found in three connections are described. Differences between the distribution functions and different polarization frequencies are demonstrated. The possibilty of establishing a bond between the statistics of annual attenuation and worst month attenuation is explored. E.A.K.

N81-27347*# National Aeronautics and Space Administration, Washington, D. C.
RADIO EMISSION OF SEA SURFACE AT CENTIMETER WAVELENGTHS AND IS FLUCTUATIONS
N. M. Tseytlin, A. M. Shutko, and G. M. Zhislin Jan. 1981 40 p refs Transl. into ENGLISH of "Radioizlucheniye Morya na Santimetrovykh Volnakh i Yego Flyuktuatsii" Rept., Moscow, 1974, 52 p Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Akademiya Nauk SSSR
(Contract NASw-3198)
(NASA-TM-76593) Avail: NTIS HC A03/MF A01 CSCL 20N

The eigen thermal radio emission of the sea was examined as well as the agitated surface of the sea when the reflection (scattering) is similar in nature to diffused scattering. The contribution of this emission to the total emission of the sea is practically constant in time, and the time fluctuations of the radio emissions of the sea are basically determined only by a change in the eigen emission of the sea, connected with the agitation. A.R.H.

N81-27348*# Grumman Aerospace Corp., Bethpage, N.Y.
DEPLOYABLE ANTENNA PHASE A STUDY Final Report, 1 May 1978 - 31 Mar. 1979
J. Schultz, J. Bernstein, G. Fischer, G. Jacobson, I. Kadar, R. Marshall, G. Pflugel, and J. Valentine 15 May 1979 232 p refs
(Contract NAS8-32394)
(NASA-CR-164569) Avail: NTIS HC A11/MF A01 CSCL 09C

Applications for large deployable antennas were re-examined, flight demonstration objectives were defined, the flight article (antenna) was preliminarily designed, and the flight program and ground development program, including the support equipment, were defined for a proposed space transportation system flight experiment to demonstrate a large (50 to 200 meter) deployable antenna system. Tasks described include: (1) performance requirements analysis; (2) system design and definition; (3) orbital operations analysis; and (4) programmatic analysis. A.R.H.

N81-27349# Communications Research Centre, Ottawa (Ontario). Technology and Systems Branch.
AN INTERACTIVE IMAGE COMMUNICATIONS SYSTEM USING PACKET SWITCHED NETWORKS
W. T. Lalonde (Norpak Ltd.) and C. D. OBrien Dec. 1980 39 p refs
(CRC-TN-701) Avail: NTIS HC A03/MF A01

A bandwidth reduction coding scheme for the transmission of image data over various communication media was developed. A two node network for interactive image communication, operating over 300 band switched telephone lines, was demonstrated. The system is based on the concept of a common visual space, wherein an identical image is presented to both users. An operation protocol for a multinode image communication system using a packet switched network as the medium of internode communication is outlined. The objective is to maintain synchronization between all of the participating nodes such that the concept of a common visual space is extended to multiple users. E.A.K.

N81-27350*# Environmental Research and Technology, Inc., Concord, Mass.
EVALUATION OF THE EFFECTS OF VARYING MOISTURE CONTENTS ON MICROWAVE THERMAL EMISSIONS FROM AGRICULTURE FIELDS Final Report
Hsiao-hua K. Burke Dec. 1980 53 p refs
(Contract NAS5-25529)
(NASA-CR-166679; ERT-P-A245) Avail: NTIS HC A04/MF A01 CSCL 20N

Three tasks related to soil moisture sensing at microwave wavelengths were undertaken: (1) analysis of data at L, X and K sub 21 band wavelengths over bare and vegetated fields from the 1975 NASA sponsored flight experiment over Phoenix, Arizona; (2) modeling of vegetation canopy at microwave wavelengths taking into consideration both absorption and volume scattering effects; and (3) investigation of overall atmospheric effects at microwave wavelengths that can affect soil moisture retrieval. Data for both bare and vegetated fields are found to agree well with theoretical estimates. It is observed that the retrieval of surface and near surface soil moisture information is feasible through multi-spectral and multi-temporal analysis. It is also established that at long wavelengths, which are optimal for surface sensing, atmospheric effects are generally minimal. At shorter wavelengths, which are optimal for atmosheric retrieval, the background surface properties are also established. J.D.H.

N81-27351# Fondazione Ugo Bordoni, Rome (Italy).
NUMERICAL TRANSMISSION BY CABLE, VOLUME 1 [TRASMISSIONE NUMERICA SU CAVO, VOLUME 1]
1980 724 p refs In ITALIAN 2 Vol.
(FUB-33/1-1980-Vol-1) Avail: NTIS HC A99/MF A01

A comprehensive manual is presented. After a brief description of historical development, the topics are grouped in the following main chapters: fundamentals of pulse code modulation of the voice signal, time division multiplexing, characteristics of transmitting media and their models, and line codes for numerical transmission. For individual titles, see N81-27352 through N81-27356.

N81-27352# Fondazione Ugo Bordoni, Rome (Italy).
NUMERICAL TRANSMISSION BY CABLE. HISTORICAL NOTES AND SUMMARY [CENNI STORICI E CONTENUTI DELL'OPERA]
Foster Bianchi, Odoarado Brugia, Renato Koch, and Aldo Roveri *In its* Numerical Transmission by Cable, Vol. 1 1980 p 27-54 refs In ITALIAN (For primary document see N81-27351 18-32)
Avail: NTIS HC A99/MF A01

The pulse code modulation technique and its succesive improvements and transformations in Europe and the U.S.A. are detailed. Included are delta modulation, packet switching and integrated service digital networks. Author (ESA)

N81-27353# Rome Univ. (Italy). Ist. Comunicazioni Elettriche.
FUNDAMENTALS OF PULSE CODE MODULATION OF THE VOICE SIGNAL [FONDAMENTI DELLA MODULAZIONE AD IMPULSI IN CODICE DEI SIGNALI VOCALI]
Luigi Giacomelli and Aldo Roveri *In* Fondazione Ugo Bordoni Numerical Transmission by Cable, Vol. 1 1980 p 55-277 refs In ITALIAN (For primary document see N81-27351 18-32)
Avail: NTIS HC A99/MF A01

The sampling process is analyzed, including the representation of band-limited deterministic signals, sampling in a random process, transfer functions of sampled signals and system response to sampled inputs. Steady state response to a sampled sinusoidal signal, transfer of sampled random processes, transient response, models of transmission systems, and time division multiplexing of sampled signals were reviewed. Noise, signal reconstruction, signal compression, code structure, sequential coding and decoding are discussed. Author (ESA)

N81-27354# Rome Univ. (Italy). Ist. Communicazioni Elettriche.
TIME DIVISION MULTIPLEXING [MULTIPLAZIONE A DIVISIONE DI TEMPO]
Maurizio Decina and Claudio Rossi (Fondazione Ugo Bordoni) *In* Fondazione Ugo Bordoni Numerical Transmission by Cable, Vol. 1 1980 p 279-386 refs In ITALIAN (For primary document see N81-27351 18-32)
Avail: NTIS HC A99/MF A01

The characteristics of time division multiplexing are explained for both pulse amplitude modulation and pulse code modulation systems. An analysis of word synchronization in asynchronous numerical multiplexing is included. The hierarchy in numerical multiplexing is discussed. The strategy for frame aligning, frame dimensioning, and the jitter of waiting time are treated. Author (ESA)

N81-27355# Rome Univ. (Italy). Ist. Comunicazioni Elettriche.
CHARACTERISTICS OF TRANSMITTING MEDIA AND THEIR MODELS [CARATTERISTICHE DEI MEZZI TRASMISSIVI E LORO MODELLI]
Giuseppe Martinelli, Gianni Orlandi, and Mario Salerno *In* Fondazione Ugo Bordoni Numerical Transmission by Cable, Vol. 1 1980 p 386-468 refs In ITALIAN (For primary document see N81-27351 18-32)
Avail: NTIS HC A99/MF A01

The characteristics of coaxial cables utilized for numerical transmission were analyzed. Mathematical models are detailed pointing out the high frequency approximation and the effects of a resistive circuit closing. The computerized simulation of coaxial cables, the measurement of characteristic parameters, the effects of noise and temperature, and the modeling of impedance irregularities are discussed. Other transmitting media are also treated, including symmetrical couples and optical fibers and their models. Author (ESA)

N81-27356# Fondazione Ugo Bordoni, Rome (Italy).
LINE CODES [CODIFICA DI LINEA]
Odoardo Brugia, Romolo Pietroiusti (Societe Italian per l'Esercizio Telefonica, Rome), Giuseppe Maria Poscetti (Rome Univ.), and William Wolfowicz *In its* Numerical Transmission by Cable, Vol. 1 1980 p 469-724 refs In ITALIAN (For primary document see N81-27351 18-32)
Avail: NTIS HC A99/MF A01

The justification characteristics, parameters, and mathematical representation and the classification of line codes are discussed. Classification and properties are detailed, including linear codes, pseudolinear codes, nonlinear codes and partial response codes. The statistical properties of the terminal digital sum are described. The average power of the coded digital signal, the error rate, and alignment procedures were analyzed. Methods for estimating the error rate were reviewed. Author (ESA)

N81-27357# Fondazione Ugo Bordoni, Rome (Italy).
NUMERICAL TRANSMISSION BY CABLE, VOLUME 2 [TRASMISSIONE NUMERICA SU CAVO, VOLUME 2]
1980 430 p refs In ITALIAN 2 Vol.
(FUB-33-2-1980-Vol-2; RIF-2B3680-Vol-2) Avail: NTIS HC A19/MF A01

Analysis and design criteria of line systems for numerical transmission by cable are discussed. Management problems in pulse code modulation, numerical transmission systems, and the status of the norms for numerical communication systems are surveyed. For individual titles, see N81-27358 through N81-27360.

N81-27358# Fondazione Ugo Bordoni, Rome (Italy).
ANALYSIS AND DESIGN CRITERIA OF THE LINE SYSTEMS FOR NUMERICAL TRANSMISSION BY CABLE [ANALISI DELLE PRESTAZIONI E CRITERI DI DIMENSIONAMENTO DEI SISTEMA DI LINEA PER TRASSMISSIONE NUMERICA SU CAVO]
Odoardo Brugia, Domenico DeSeta, Luigi Giacomelli (Rome Univ.), Renato Lucarelli, Wolfgang Maggi, Giuseppe Martinelli (Rome Univ.), Gianni Orlandi (Rome Univ.), Aldo Roveri (Rome Univ.), Mario Salerno (Rome Univ.), and William Wolfowicz *In its* Numerical Transmission by Cable, Vol. 2 1980 p 737-1049 refs In ITALIAN (For primary document see N81-27357 18-32)
Avail: NTIS HC A19/MF A01

The design of line decoders, transmitting media, repeaters, power sources and remote surveillance systems is analyzed. The computation of error probability and the optimization methods for base band numerical transmission systems are discussed. Performance of quantized feedback equalizers and the incidence of jitter in regenerative repeaters are examined. Author (ESA)

N81-27359# Rome Univ. (Italy). Ist. Comunicazioni Elettriche.
MANAGEMENT PROBLEMS IN PCM NUMERICAL TRANSMISSION SYSTEMS [PROBLEMI DI GESTIONE DEI SISTEMI DI TRASMISSIONE NUMERICA PCM]
Maurizio Decina and Umberto DeJulio (Societe Italian per l'Esercizio Telefonica, Rome) *In* Fondazione Ugo Bordoni Numerical Transmission by Cable, Vol. 2 1980 p 1051-1093 refs In ITALIAN (For primary document see N81-27357 18-32)
Avail: NTIS HC A19/MF A01

The management and utilization criteria of numerical transmission systems for numerically integrated telecommunication networks are discussed. The economic and quality aspects of insertion of digital systems in existing networks, and maintenance of digital systems are given emphasis. Fundamental problems, such as error and jitter distribution along the network sections, are yet in a preliminary phase of study. Author (ESA)

N81-27360# Fondazione Ugo Bordoni, Rome (Italy).
THE STATUS OF NORMS FOR NUMERICAL COMMUNICATION SYSTEMS [STATO ATTUALE DELLA NORMATIVA SUI SISTEMI NUMERICI DI COMMUNICAZIONE]
Gastone Bonaventura (Azienda di Stato per i Servizi Telefonica), Umberto DeJulio (Soc. Ital. per l'Esercizio Telefonica, Rome), and Domenica DeSeta *In its* Numerical Transmission by Cable, Vol. 2 1981 p 1095-1152 refs In ITALIAN (For primary document see N81-27357 18-32)
Avail: NTIS HC A19/MF A01

The Italian, European and international norms referring to numerical communication systems are reviewed. The norms referring to the characteristics of analog to digital conversion, the quality level, the multiplexing devices and the numerical line systems are examined. The trends in norm development are discussed, in particular those referred to wave guides and optical fibers and those considering multiplexing levels higher than four. Author (ESA)

N81-27361# Rome Air Development Center, Griffiss AFB, N.Y.
THEORETICAL AND EXPERIMENTAL STUDIES OF HF DUCTED PROPAGATION
Terence J. Elkins, Kurt Toman, and Gary S. Sales Dec. 1980 65 p refs
(AD-A098944; RADC-TR-80-360) Avail: NTIS HC A04/MF A01 CSCL 20/14

Results of an ionospheric radio propagation experiment are discussed which involved high-frequency ionospheric radars located in California, New York, and Australia, with their radiation aimed toward an artificially modified volume of the ionospheric F-region over Platteville, Colorado. Signals originating from these radars were received at field sites in Los Alamos, New Mexico,

and Alamosa, Colorado. It has been surmised that signals could arrive at these sites by several types of propagation mechanisms; for example, conventional multihop propagation along a great-circle path with or without final-hop scattering from the artificial irregularity volume. In another mechanism, likely to be operative for the Australian transmission, the signal at times was expected to be ducted in the F-region of the ionosphere, arrive at the artificial irregularity volume with the propagation vector being nearly horizontal, and be backscattered toward the receiving sites. For comparison, characteristics of round-the-world signals are identified. Considerations of scattering from artificially induced field-aligned ionospheric irregularities are presented. The interpretation of results is facilitated by a numerical study in which raytracing through computationally specified model ionospheres is employed. Ducting predictions are described using the potential field technique. Propagation losses are estimated from raytracing through ionospheric models. The detection of ducted signals by means of an artificially induced scatter volume is shown to be possible. Author (GRA)

N81-27362# Mission Research Corp., Santa Barbara, Calif.
OPTIMAL/ADAPTIVE DEMODULATION FOR M-ARY FSK IN FAST FADING Final Report
M. J. Barrett Kirtland AFB, N. Mex. AFWL Mar. 1981 133 p refs
(Contract F29601-78-C-0033; AF Proj. 4695)
(AD-A099512; MRC-R-453; AD-E200714; AFWL-TR-80-69) Avail: NTIS HC A07/MF A01 CSCL 17/2

This work extends the analysis developed in a preceding report, of optimal demodulation for M-ary FSK waveforms that are corrupted by rapid signal scintillation fading and noise. The research documented here extends the original analysis to incorporate estimation algorithms for signal spectral spreading. This new receiver design adapts to channel conditions and is called the optimal/adaptive demodulator. The optimal/adaptive demodulator operates like the optimal receiver previously documented except that it also forms the necessary spectral estimates of the received signal plus noise. The new design remains optimal, in the sense of minimum probability of error, in steady signal and slow fading conditions while providing successful performance in much faster fading conditions than possible with conventional receivers. The mathematical development, design and performance of the new optimal/adaptive demodulator are documented in this work. GRA

N81-27363# Naval Research Lab., Washington, D. C. Radar Analysis Branch.
MAXIMUM LIKELIHOOD ANGLE ESTIMATES OF TWO SIGNALS USING THREE SQUINTED BEAMS (SYMMETRIC SOLUTION) Interim Report
B. H. Cantrell 29 May 1981 15 p refs
(RR0210541)
(AD-A099810; NRL-8481) Avail: NTIS HC A02/MF A01 CSCL 17/9

The maximum likelihood estimates of the elevation angles of two closely spaced targets is considered. For an antenna constructed with three squinted beams a simple closed-form solution for the elevation angle is found. The solution is only valid when the center of the middle beam is directed toward the bisecting line between the sources and the principal axes of the antenna are parallel to the perpendicular to the line connecting the sources. This condition can be obtained with an antenna viewing an emission or reflection over a smooth reflecting sea. The accuracy of solution is studied using simulation procedures. The accuracy is found to be comparable to maximum liklihood solutions using an array antenna. Author (GRA)

N81-27364# Network Analysis Corp., Vienna, Va.
COMMUNICATIONS SUPPORT FOR AREA A AND REQUEST/REPLY Final Report
Apr. 1981 228 p refs
(Contract DOT-FA79WA-4335)
(AD-A100009; NAC/FR.303C; FAA-RD-81-37) Avail: NTIS HC A11/MF A01 CSCL 17/2

Service A communication requirements were analyzed to determine the optimal communications support strategy, with the National Airspace Data Interchange Network (NADIN) integration as one of the primary alternatives to be evaluated. That analysis yielded the following conclusions: integration of Service A into NADIN will reduce monthly leased line recurring costs; NADIN use will result in little or no increase in total present value cost; Service A integration into NADIN is not feasible prior to WMSC replacement; WMSC Replacement design will be simplified by use of NADIN support for Service A; and NADIN will improve Service A performance by permitting cost effective circuit reconfiguration. In addition, the analysis determined detailed enhancements to NADIN required to support Service A while adequately maintaining other NADIN traffic. GRA

N81-27365# Army Electronics Research and Development Command, Fort Monmouth, N. J. Night Vision and Electro-Optics Labs.
OBSERVER PERFORMANCE MEASURED AGAINST HYBRID COMPRESSED VIDEO IMAGERY
Joseph E. Swistak Mar. 1981 19 p refs
(AD-A099758; DELNV-TR-0019) Avail: NTIS HC A02/MF A01 CSCL 09/3

A study was conducted in which the effects of bits per pixel reductions on target detection and recognition were measured. A hybrid DCT/DPCM compression algorithm was used to manipulate the bit-per-pixel reduction rate. The algorithm was implemented in the form of a software simulation package on a general-purpose minicomputer facility. Using this facility, real-time imagery was reduced from analog to 8- and 2-bit-per-pixel levels at 1-frame-per-second update rates. Observers were asked to detect and recognize targets located in the imagery. Average detection and recognition slant ranges were calculated for each target and compression level. No significant differences in performance were noted due to the different compression levels. Author (GRA)

N81-27366# Harry Diamond Labs., Adelphi, Md.
COMMUNICATORS FOR HIGH-NOISE-LEVEL ENVIRONMENTS
Robert F. Shoemaker and Edwin H. Harrison Apr. 1981 16 p
(AD-A099557; HDL-TM-81-11) Avail: NTIS HC A02/MF A01 CSCL 17/2

At the request of the U.S. Geological Survey, the feasibility of equipping workers with a two-way communications system built into a construction hard hat for use in an extremely high ambient noise level has been investigated. As a result, several systems were tested on an offshore oil platform in the Gulf of Mexico. The investigation indicates that a simple modification of a commercial low-power, frequency modulated system operating in the 49-MHz public service band could be used to considerable advantage. Penetration through platform structures was excellent, and communication was possible from within an enclosed steel compressor room where noise levels were as high as 97 dBA to all points on the platform. Author (GRA)

N81-27367# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
OUT-OF-BAND REFLECTOR ANTENNA MODEL Final Technical Report, 15 Mar. 1980 - 14 May 1981
T. B. Wels and Charles E. Ryan, Jr. 15 May 1981 118 p refs
(Contract DAAG29-80-C-0083)
(AD-A099896; GIT/EES-A-2610; ARO-17033.1-EL-A) Avail: NTIS HC A06/MF A01 CSCL 20/14

During this program, a flexible, interactive program for Monte Carlo analysis of near-field and far-field fields of a prime focal fed out-of-band paraboloidal reflector antenna was developed and used for numerical simulation. The simulations are not sensitive to frequency only averaging. The distribution of the modal coefficient phases has the greatest effect on the numerically simulated patterns. The numerical simulations also indicate the validity of near-field ensemble measurements in far-field pattern prediction and the role of near-field correlation terms in these patterns. GRA

N81-27368# Georgia Inst. of Tech., Atlanta. Electromagnetics Lab.
PARAMETRIC INVESTIGATION OF RADOME ANALYSIS METHODS. VOLUME 4: EXPERIMENTAL RESULTS Final Technical Report, 30 Sep. 1977 - 31 Dec. 1980

H. L. Bassett, J. M. Newton, W. Adams, J. S. Ussailis, M. J. Hadsell, and G. K. Huddleston Feb. 1981 189 p
(Grant AF-AFOSR-3469-77; AF Proj. 2301)
(AD-A100017; AFOSR-81-0462TR-Vol-4) Avail: NTIS HC A09/MF A01 CSCL 17/9

This Volume 4 of four volumes presents 140 measured far-field patterns and boresight error data for eight combinations of three monopulse antennas and five tangent ogive Rexolite radomes at 35 GHz. The antennas and radomes, all of different sizes, were selected to provide a range of parameters as found in the applications. The measured data serve as true data in the parametric investigation of radome analysis methods to determine the accuracies and ranges of validity of selected methods of analysis. Author (GRA)

N81-27369# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
RADAR BACKGROUND SIGNAL REDUCTION STUDY Final Report
E. F. Knott, C. J. Ray, M. S. West, and R. J. Wohlers Jul. 1980 126 p refs
(Contract F29601-79-C-0050; AF Proj. A-2403)
(AD-A099560; GIT/EES-A-2403-F) Avail: NTIS HC A07/MF A01 CSCL 17/9

This report summarizes a study whose objective was to identify materials and/or techniques to reduce radar background signals for ground plane radar cross section (RCS) ranges. Background signal reduction is essential for improving the accuracy of RCS measurements and the primary application is for operations at the RATSCAT range on the White Sands Missile Range in New Mexico. A survey of current literature revealed no new materials or techniques. A computer-aided design study showed that the control of the electrical properties of a target support column has few benefits, although one specific design showed substantial performance capabilities if fabrication techniques can be developed. A numerical post facto method (vector field subtraction) for background reduction was evaluated by the use of mathematically generated data. The results showed that aspect angle alignment is important and experimental verification and evaluation is clearly needed. Column shaping was studied experimentally, but the results were inconclusive. The 'volume' return from a target support column may constitute the irreducible signal, which is unaffected by shape. Low frequency background signals are due to inadequate instrumentation and anomalies in the ground plane behavior. Diagnostic testing was suggested as a way of determining the background signal sources, and test results should indicate the corrective action to be taken. Author (GRA)

N81-27370# Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.
ELECTROMAGNETIC TRANSMISSION THROUGH A ROTATIONALLY SYMMETRIC HOLE IN A THICK SCREEN
Chung-Chi Cha and Roger F. Harrington Jun. 1981 107 p refs
(Contract N00014-76-c-0225)
(AD-A099906; TR-81-2; TR-13) Avail: NTIS HC A06/MF A01 CSCL 20/14

Electromagnetic wave transmission through an aperture in a thick conducting screen is investigated. The aperture is assumed to be rotationally symmetric about an axis normal to the screen. The equivalence principle is used to divide the original problem into three regions. Fields in each region are expressed in terms of equivalent currents on the boundary, and integral equations for the unknown currents are established by enforcing proper boundary conditions. When the aperture region in the screen is a section of a cylindrical or coaxial waveguide, the waveguide modes can be used to construct the operators in that region. In this case the boundary condition for the E-field on the waveguide walls is built into the operator. However, in a more general situation, operators in an unbounded medium are used and an extra integral equation is written for the aperture region, resulting in a larger system of equations. The moment method is used to solve the integral equations numerically and results are presented. An equivalent circuit is also developed for a narrow annular slot at low frequencies. Resonant behavior predicted from the circuit is supported by numerical results. Author (GRA)

N81-27371# Texas Univ. at Arlington. Applied Research Labs.
AXISYMMETRIC PROPAGATION OF A SPHERICAL N WAVE IN A CYLINDRICAL TUBE M.S. Thesis
Robert Dale Essert, Jr. 4 May 1981 166 p refs
(Contract N00014-75-C-0867)
(AD-A099990; ARL-TR-81-22) Avail: NTIS HC A08/MF A01 CSCL 20/1

An experimental and theoretical study of the propagation of a spherical N wave in a rigid cylindrical tube is presented. Both source, an electric spark, and receiver, a very wideband condenser microphone, were located on the tube axis. Spark energies of between 0.04 J and 2.3 J were used. The received signal is a series of pulses. The first pulse is the direct N wave, which travels straight down the axis. Subsequent pulses represent waves reflected from the tube wall; their waveforms vary (they are not N shaped). There is, however, a shape repetition every fourth reflected wave. A theoretical analysis of the problem was based on a solution of the linear wave equation for a dissipative medium. The solution, expressed as a ray expansion, indicates that the variation in pulse shape for low energy sparks is due primarily to focusing of the reflected rays each time they cross the tube axis: Each focus is accompanied by a 90 degree phase shift of the components making up the pulse. It was also found that atmospheric absorption and microphone directivity have important effects on the shapes of the received pulses. Both analytical and numerical methods were used to compute individual pulse waveforms from the theoretical results. For low spark energies (-0.1 J) computed and measured waveforms are in good agreement. For higher spark energies (=0.1 J) the shapes of the measured waveforms are altered by finite amplitude effects, and the simple linear theory is no longer sufficient to explain the results. A numerical propagation algorithm, which includes nonlinear propagation distortion, has been proposed. A qualitative rendering of the algorithm accounts reasonably well for the observed changes in wave shape. Author (GRA)

N81-27372# Transportation Systems Center, Cambridge, Mass.
DETECTION PERFORMANCE EVALUATION OF THE ASDE-3 USING FIXED FREQUENCY AND FREQUENCY AGILE OPERATION Final Report, Jan. - Apr. 1980
P. J. Bloom, G. J. Bishop, and J. E. Kuhn Mar. 1981 104 p
(AD-A099513; DOT-TSC-FAA-81-8; FAA-RD-81-41) Avail: NTIS HC A06/MF A01 CSCL 17/9

The ASDE-3 (Airport Surface Detection Equipment) Radar design has many features to enhance operational usefulness. The purpose of all these features is to provide a better airport surface surveillance display for the control power tower cab. One of these features is the use of frequency agility, the transmission at a different frequency within a frequency band during each radar transmit time. The function of this feature is to improve the detection performance of the ASDE radar and thereby improve the quality of the information presented on the operational display. The use of frequency agility reduces image breakup of aircraft on the display and, in rainy weather, allows the display of ground traffic during much heavier precipitation than achievable with fixed frequency operation. This report discusses the role of the ASDE in airport surface traffic control, and the theory of frequency agility benefits, and gives the empirical results obtained during field experiments using the ASDE-3 engineering model test bed. GRA

N81-27373# SRI International Corp., Menlo Park, Calif.
CONTINUED PERFORMANCE OF THE WIDEBAND SATELLITE EXPERIMENT Final Report, 1 Jun 1977 - 31 Jan. 1981
Charles L. Rino, Robert C. Livingston, Boyd C. Foir, and Michael D. Cousins 31 Jan. 1981 52 p refs
(Contract DNA001-77-C-0220)
(AD-A099819; DNA-5503F) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report summarizes the work completed during the active data-taking phase of the Wideband Satellite Program. The report includes a complete description of the Wideband satellite data base and a summary of the accomplishments of the program in the areas of propagation theory, channel modeling, and the structure and development of the naturally-occurring ionospheric

irregularities that cause scintillation. A complete bibliography is included. Author (GRA)

N81-27374# SRI International Corp., Arlington, Va.
IRREGULARITIES IN IONOSPHERIC PLASMA CLOUDS: THEIR EVOLUTION AND EFFECT ON RADIO COMMUNICATION
J. F. Vesecky, J. W. Chamberlain, J. M. Cornwall, D. A. Hammer, and F. W. Perkins Sep. 1980 137 p refs
(Contract DNA001-79-C-0362)
(AD-A099770; SRI-JSR-80-15) Avail: NTIS HC A07/MF A01 CSCL 20/14

Both satellite radio communications, which travel through the Earth's ionosphere, and high frequency (HF) sky wave circuits, which use the ionosphere as a refracting medium, can be strongly affected by radio wave scintillation. High altitude nuclear explosions cause scintillation (by strongly disturbing the ionosphere) and thus severely degrade satellite radio communications over a large region. Since further atmospheric nuclear tests are banned, a thorough understanding of the physics involved in both the disturbed ionosphere and its interaction with radio waves is necessary in order to design radio communications systems which will operate satisfactorily in a nuclear environment. During the 1980 JASON Summer Study we addressed some aspects of the evolution of ionospheric irregularities following a high altitude nuclear explosion--the radio wave propagation theory being apparently well understood for the satellite link case. In particular, we have worked on irregularity evolution at late times (approx. hours) after an explosion and the impact of early time irregularity structure on late time evolution. We also raise the question of scintillation effects on HF sky wave communications. GRA

N81-27375# Department of Energy, Oak Ridge, Tenn. Technical Information Center.
VIDEODISC TECHNOLOGY
F. E. Marsh, Jr. Mar. 1981 28 p refs Presented at the 16th Ann. Conf. of the East Tennessee Chapter of the Assoc. of Records Managers and Administrators, Inc., Knoxville, Tenn., 26 Mar. 1981
(CONF-810322-1) Avail: NTIS HC A03/MF A01

An overview of the technology of videodiscs is given. The emphasis is on systems that use reflection or transmission of laser light. Possible use of videodiscs for storage of bibliographic information is considered. DOE

N81-27376# Fondazione Ugo Bordoni, Rome (Italy).
MULTIPLE ROUTING CIRCUIT COST MINIMIZATION FOR A TRANSMISSION NETWORK [MINIMIZZAZIONE DEL COSTO DELL'ISTRADAMENTO MULTIPLO DEI CIRCUTTI IN UNA RETE DI MEZZI TRANSMISSIVI]
Ugo Mocci Dec. 1979 24 p refs In ITALIAN
(FUB-38-1979) Avail: NTIS HC A02/MF A01

The problem of minimizing costs for networks with routing path and diversification boundaries, and that of maximizing the number of alternate routing paths for a given cost and network geometry are studied. The mathematical model is limited to networks which can be described by multigraphs and where network costs are a function of the individual branch cost only. The model is also limited to paths using the same number of circuits. Two heuristic procedures and solution algorithms are discussed. An existing computer program (OSRI) is modified for application of the proposed methods. Examples are included. Author (ESA)

N81-27377# Fondazione Ugo Bordoni, Rome (Italy).
OPTIMIZATION METHODS FOR ALTERNATE ROUTING HIERARCHIAL NETWORKS [METODI DI OTTIMIZZAZIONE PER RETI GERARCHIEAD ISTRADAMENTO ALTERNATIVO]
Sandra Spedaletti Dec. 1978 30 p refs In ITALIAN
(FUB-41-1979) Avail: NTIS HC A03/MF A01

The number of circuits needed to minimize total network cost at a given communication loss probability is determined by considering only network sections, which allows the use of simpler and faster methods. The methods which take into account the whole of the network are reviewed, and their complexity when applied to large telephonic systems is reviewed. The methods which are applicable to small network sections are examined, and the differences between these solutions and global network solutions are discussed. It is concluded that the proposed methods are preferable when the problem is part of a large planning project or when high accuracy is not demanded. Author (ESA)

N81-27378# Fondazione Ugo Bordoni, Rome (Italy).
AN EXPERIMENT FOR THE REPRESENTATION OF VOICE SIGNALS BY MEANS OF AN ALGORITHM BASED ON A PRODUCT OF HOMOTOPIC CORRELATIONS [UN ESPERIMENTO DI RAPPRESENTAZIONE DEL SEGNALE VOCALE MEDIANTE UN ALGORITMO BASATO SU UN PRODUTTO DI CORRELAZIONE OMOTOPICA]
Foster Bianchi and Lucio Prina-Ricotti Sep. 1979 30 p In ITALIAN Prepared in cooperation with Centro Studi e Lab. Telecomunicazioni
(FUB-43-1979) Avail: NTIS HC A03/MF A01

An algorithm derived from a model of the human auditive system is presented and used for the analysis of voice signals. The algorithm is defined as a transformation, involving the homotopic products along the model delay line and weighting functions related to the receptor memories. The model consisted of 65 receptors equally spaced along the two sides of a delay line with a delay constant of 0.1 msec between receptors. The time weighting functions are exponential and were chosen to obtain an attenuation of 20 db in 25 msec. It is shown that the homotopic correlation algorithm can follow variations in signal strength and provides adequate information on the characteristics of small signal segments. Author (ESA)

N81-27379# Fondazione Ugo Bordoni, Rome (Italy).
VOWEL RECOGNITION WITH FIRST, SECOND AND THIRD ORDER AUTOCORRELATION [RICONOSCIMENTO DELLE VOCALI CON AUTOCORRELAZIONI DI ORDINE 1, 2 E 3]
Lucio Prina-Ricotti Sep. 1979 32 p refs In ITALIAN Prepared in cooperation with Centro Studi e Lab. Telecomunicazioni
(FUB-44-1979) Avail: NTIS HC A03/MF A01

The efficiency of an autocorrelation algorithm for speech recognition was evaluated experimentally, using vowels pronounced by Italians. The results were compared with those from other methods, such as average logarithmic spectral distance, cepstral distance, the likelihood ratio method, and cosH measurement. It is shown that higher order autocorrelations are necessary for attaining acceptable precision but because of the length of the computation the function is practical only for $n = 2$.
Author (ESA)

N81-27380# Fondazione Ugo Bordoni, Rome (Italy).
REPORT ON COLLABORATION BETWEEN THE UGO BORDONI FOUNDATION AND THE SUPERIOR INSTITUTE OF POST AND TELECOMMUNICATIONS DURING 1979 Annual Report, 1979 [RELAZIONE SULL'ATTIVITA DI COLLABORAZIONE CON L'INSTITUTO SUPERIORE POSTE E TELECOMUNICAZIONI NEL 1979]
Renato Koch Feb. 1980 41 p refs In ITALIAN
Avail: NTIS HC A03/MF A01

The research activities are summarized. Main topics are radio communication systems, cable and digital communication systems, automatic systems for communication, management and control, and laser and optoelectronic systems. A list of publications is included. Author (ESA)

N81-27381# Southampton Univ. (England). Inst. of Sound and Vibration Research.
THE EFFECTS OF WALL DISCONTINUITIES ON THE PROPAGATION OF FLEXURAL WAVES IN CYLINDRICAL SHELLS
C. R. Fuller Mar. 1980 62 p refs Sponsored by UK Ministry of Defence
(ISVR-TR-106) Avail: NTIS HC A04/MF A01

The transmission of flexural type waves through various discontinuities in the walls of cylindrical shells was investigated. Theoretical curves of transmission loss were obtained for different circumferential wavenumbers and wave types, as functions of frequency. Material stiffness and extensional phase speed, together with the relationship between radial vibration amplitude and total wave power of propagation, were important

factors which were found to strongly influence wave transmission through discontinuities. Some practical results useful for predicting the performance of typical pipe isolators (in vacuo) were also obtained. Author (ESA)

N81-27382# AEG-Telefunken, Ulm (West Germany). Nachrichten- und Verkehrstechnik AG.
STUDY OF VARIOUS POSSIBILITIES FOR RADIO TRANSMISSION VIA SATELLITE TO MOBILE STATIONS (TERSAT) Final Report
Gert Eckhardt, Albert Nelson, Roland Briechle, and Detlef Otto (Technische Univ., Berlin) Bonn Bundesministerium fuer Forschung und Technologie Nov. 1980 139 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-80-004; ISSN-0170-1339) Avail: NTIS HC A07/MF A01

Communication services which presently exist as terrestrial networks are shown adaptable to include satellite transmission. Suitable services are selected, addressing transmission problems which arise when mobile stations are involved. Frequency range, fading effects, multipath propagation, and antennas are discussed. Proposals are made for the operation of the selected services, and the required transmission powers are calculated. Results show that with a satellite the size of a radio TV satellite for two countries several services are feasible in the 900 MHz range, i.e., 3 radio channels, a traffic radio channel, an European radio-telephone channel, and 21 narrow band data transmission channels as well as 26 radio-telephony channels, available for police and other special services. Author (ESA)

N81-27383# Research Inst. of National Defence, Stockholm (Sweden).
COMPUTER SIMULATION OF DETONATION WAVES
Nils Hoernqvist and Janerik Persson Dec. 1980 18 p refs
(FOA-C-20390-A2) Avail: NTIS HC A02/MF A01

Results from computerized simulation of the detonation wave generated by a high explosive (TNT) are compared with the theoretical solution. The number of mesh points needed to model the detonation wave and the time necessary for establishing its presence are found. It is shown that the studied detonation wave simulation method requires at least 50 mesh points inside the charge to give a reasonable approximation of a detonation wave. Moreover, the time and location of the simulated wave lag behind a real detonation wave, indicating that comparison between experiment and numerical simulations must be corrected to include this effect. Author (ESA)

N81-27384# Fondazione Ugo Bordoni, Rome (Italy).
INFLUENCE OF TELEVISION RECEIVER CHARACTERISTICS ON A CIRCULAR DIFFUSION TELETEXT SYSTEM [INFLUENZA DELLE CARATTERISTICHE DEI RICEVITORI TELEVISIVI SULLE PRESTAZIONI DI UN SISTEMA TELETEXT A DIFFUSIONE CIRCOLARE]
Gennaro Gallinaro, Paolo Mandarini (Rome Univ.), and Roberto Stanchi Nov. 1980 25 p refs In ITALIAN
(FUB-24-1980; RIF-1B2280) Avail: NTIS HC A02/MF A01

The minimum signal to noise ratios at the input of the television receiver which can assure a preestablished service quality is determined for several operational conditions. The receiver performance in real operation is examined, and the worsening of the signal to noise ratio due to echoes in the electromagnetic link is analyzed. The results are presented in table form, and cover the necessary signal to noise ratios and visual effects corresponding to several operating conditions and demodulating systems. Author (ESA)

N81-27385# Fondazione Ugo Bordoni, Rome (Italy).
STATISTICAL TECHNIQUES FOR SPEAKER IDENTIFICATION [TECNICHE STATISTICHE NELLA IDENTIFICAZIONE DEL PARLANTE]
Antonio Federico (Comitato Nazionale per l'Energia Nucleare), Giovanni Ibba, and Andrea Paoloni Oct. 1980 26 p refs In ITALIAN
(FUB-25-1980; RIF-2B2980) Avail: NTIS HC A03/MF A01

The theoretical problem of identifying the speaker by statistical analysis of his voice signal is discussed. The interpretation model and parameter validity are examined, defining the covariance matrix which characterize the correlation structure of the individual speaker. The reduction of the number of variables and the problems for establishing a practical model are analyzed. The identification of one particular speaker among a large number of speakers is considered. Author (ESA)

N81-27386# Fondazione Ugo Bordoni, Rome (Italy).
CROSS-POLARIZATION DATA ANALYSIS IN LINEAR POLARIZATION AT 17.8 GHz [ANALISI DEI DATI DI CROSS-POLARIZZAZIONE IN POLARIZZAZIONE LINEARE AT 17.8 GHz]
Dario Maggiori, Piergiorgio Migliorini, and Aldo Paraboni (Polytec. di Milan) Oct. 1980 20 p refs In ITALIAN
(FUB-26-1980; RIF-1B1880) Avail: NTIS HC A02/MF A01

Depolarization at 17.8 GHz in experimental radio links was measured. A transmission was made initially with vertical polarization only, while receiving in both vertical and horizontal directions. Then both transmission and reception were tilted at the same angle. The aim was to provide experimental data for rain interference studies. The results are presented in form of charts and histograms and show the interaction between rain characteristics and transmission parameters. Author (ESA)

N81-27387# Fondazione Ugo Bordoni, Rome (Italy).
STATISTICAL ANALYSIS OF THE ZEROES SEQUENCES EMITTED BY AUTOSYNCHRONIZING SCRAMBLERS [ANALISI STATISTICA DELLE SEQUENZE DI ZERI EMESSE DA SCRAMBLER AUTOSINCRONIZZANTI]
Odorado Brugia, Giovanni Campanini, Romolo Pietroiusti, and William Wolfowicz Oct. 1980 29 p refs In ITALIAN
(FUB-28-1980; RIF-2B3080) Avail: NTIS HC A03/MF A01

The incidence of introducing a scrambler on the statistics of the zeros sequences in 565 Mbit/sec numerical systems was analyzed for three different antosynchronizing scramblers. Scrambler use was proposed to improve the performance codes of line codes which leave unchanged the original zero sequences. The statistical properties of the zeros sequences at the inlet and outlet of the three types of scrambler were studied. Results indicate that at least one of the examined scramblers can maintain timing for an average of more than two months. It is concluded that the choice of line code may not be limited by timing considerations. Author (ESA)

N81-27388# Fondazione Ugo Bordoni, Rome (Italy).
A METHOD FOR SEGMENTING CONTINUOUS SPEECH BY MEANS OF THE 'HOMOTOPICS' OF THE BAND FILTERED SIGNAL [UN METODO DI SEGMENTAZIONE DEL PARLATO CONNESSO MEDIANTE L'USO DI 'OMOTOPICHE' DEL SIGNALE FILTRADO A BANDE]
Foster Bianchi, Paolo Pocci, and Lucio Prina-Ricotti Jun. 1980 30 p In ITALIAN Prepared in cooperation with Centro Studi e Lab. Telecommunicazioni
(FUB-29-1980; RIF-2B1780) Avail: NTIS HC A03/MF A01

Homotopic correlations are used to segment continuous speech because of its ability to follow fast signal variations and its property of assuming strongly different configurations. The experiment was carried on using a single italian language phrase, filtered, sampled at 20 KHz, and converted into an 8 bit digital signal. The signal was filtered in three bands, and for each, 33 homotopic correlation coefficients were calculated. The coefficients are recalculated each 1,6 msec. The segmentation is done making a variable distance correlation between the homotopic curves. The results are analyzed discussing several cases of difficult detection of inter-phenoma transitions. Author (ESA)

N81-27389# Fondazione Ugo Bordoni, Rome (Italy).
SPEECH MULTIPLE REPRESENTATION BY HOMOTOPICS OBTAINED BY SIGNAL PROCESSING BAND-FILTERED WITH FIR FILTERS [RAPPRESENTAZIONI MULTIPLE DEL PARLATO MEDIANTE 'OMOTOPICHE' OTTENUTE DA ELABORAZIONI DI SEGNALI FILTRATI A BANDE CON FILTRI FIR]
Foster Bianchi, Paolo Pocci, and Lucio Prina-Ricotti May 1980 42 p In ITALIAN Prepared in cooperation with Centro Studi e Lab. Telecomunicazioni
(FUB-30-1980) Avail: NTIS HC A03/MF A01

The set of the homotopic products in the output of a hearing

system model, characterized from their distance to a reference point, are used to represent the voice signal for speech recognition based on the correlation among those products. The hearing channel model is a double delay line of 33 elements with 50 micro sec delay each. Some 2048 samples of italian vowels were registered on a 8 bit tape by two speakers, and the use of FIR filters in signal processing evaluated. The rate of recognition using the homotopic products algorithm is high, and the addition of filters increases the efficiency of the method. Author (ESA)

N81-27390# Fondazione Ugo Bordoni, Rome (Italy).
A JITTER DEMODULATOR FOR LABORATORY MEASUREMENT [REALIZZAZIONE DI UN DEMODULATORE DI JITTER PER MISURE DI LABORATORIO]
Domenico DeSeta, Giorgio Fruscalzo, and Wolfango Maggi Nov. 1980 19 p refs In ITALIAN
(FUB-31-1980) Avail: NTIS HC A02/MF A01

A device for demodulating and measuring the jitter signal present in a timing pulse signal is described. The device was implemented for timing jitter measurement in numerical links, in particular for characterization of PCM regenerative repeaters. Logical and electrical diagrams are included and measurement examples are presented. Author (ESA)

N81-27391# Fondazione Ugo Bordoni, Rome (Italy).
A MEASUREMENT PROGRAM ON A NUMERICAL RADIO LINK IN THE 11 GHz BAND [PROGRAMMA DI RILEVAMENTI SPERIMENTALI SU COLLEGAMENTI IN PONTE RADIO NUMERICI NELLA BANDA DEGLI 11 GHz]
Fabio Andreucci, Dario DiZenobio, and Pier Giorgio Marchetti May 1980 44 p In ITALIAN
(FUB-32-1980) Avail: NTIS HC A03/MF A01

A communication traffic simulation system was designed in an experimental 11 GHz channel at 140 Mbit/sec in three terrestrial links from 36 to 54 km. The difficulties of adapting these large capacity systems to existing Italian infrastructure is assessed. The measuring and monitoring equipment are detailed, including receptors, sequence generators, error detectors, error counters, pluviometers, HP1000 computer, microprocessors, and teletypes. Data acquisition and data processing are described. The purpose of this measuring and monitoring system is to determine error probalities and field intensity in reception, in function of several meteorological and design parameters.
Author (ESA)

N81-27392# Canadian Astronautics Ltd., Ottawa (Ontario).
INVESTIGATION OF TOLERANCE ANALYSIS OF REFLECTOR ANALYSIS
W. F. Payne Paris ESA Oct. 1980 113 p refs
(Contract ESTEC-4194/79-NL-DG(SC))
(ESA-CR(P)-1416) Avail: NTIS HC A06/MF A01

A computer algorithm is described which permits the establishment of tolerances on selected reflector antenna geometrical parameters, by using as inputs the allowable change permitted in the antenna electrical performance parameters. This approach is the reverse of the conventional design procedure, and can only be accomplished by apportioning a fraction of the total change in a given parameter to a specific error source. In order to define the required relationships between error source and resultant error, it is necessary to use a computer algorithm which permits the user to calculate the effects of distortion of reflector geometry on selected antenna performance parameters. The relevant error sources are defined, and mathematical models of these sources are presented. A representative algorithm is described and a demonstration of the algorithm is presented showing typical results of calculations performed with existing software. Author (ESA)

N81-27393# Mitre Corp., McLean, Va. METREK Div.
POTENTIAL USE OF SPREAD SPECTRUM TECHNIQUES IN NON-GOVERNMENT APPLICATIONS Final Report, Dec. 1979 - Dec. 1980
Walter C. Scales Dec. 1980 220 p refs
(Contract FCC-0320)
(PB81-165284; MTR-80W335; FCC/OST/TPS-81-1) Avail: NTIS HC A10/MF A01 CSCL 17B

Spread spectrum technologies have evolved primarily in military and aerospace environments, where the usual objectives are to provide resistance to jamming, multipath and interception. Spread spectrum techniques may also have applications that fall under the jurisdiction of the FCC. In some civil applications, spread spectrum can provide communication privacy and multiple access on a transmit-at-will basis. In certain cases, spread spectrum may be a practical, spectrum-efficient approach, although spread spectrum hardware is not currently available on a commercial basis. An example is given of a land mobile communication system using slow frequency hopping. Simulation results indicate that this technique might provide short-range service in applications when random channel access is an important feature. GRA

N81-27394# Institute for Telecommunication Sciences, Boulder, Colo.
CALCULATION OF GEOSTATIONARY SATELLITE FOOTPRINTS FOR CERTAIN IDEALIZED ANTENNAS
K. P. Spies and E. J. Haakinson Oct. 1980 59 p refs
(PB81-168379; NTIA-REPT-80/51) Avail: NTIS HC A04/MF A01 CSCL 09E

Methods are described for calculating under certain simplifying assumptions, footprints (contours of constant power density) for idealized models of several common types of transmitting antennas (circular aperture, elliptical aperture, rectangular aperture, and helical beam antennas), and for antenna beams of specified but rather arbitrary shape. The transmitter is mounted on a satellite at a prescribed location in the geostationary orbit and has its main lobe axis directed toward a given aim point on the Earth. GRA

N81-27133*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CAPACITY OF A MULTIMODE DIRECT DETECTION OPTICAL COMMUNICATION CHANNEL
H. H. Tan (California Univ. at Irvine) *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 51-70 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N81-27134*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EFFECTS OF THE GASEOUS AND LIQUID WATER CONTENT OF THE ATMOSPHERE ON RANGE DELAY AND DOPPLER FREQUENCY
W. L. Flock *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 71-86 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

N81-27135*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ATMOSPHERIC NOISE TEMPERATURE MEASUREMENTS
C. T. Stelzried *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 87-96 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

N81-27140*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A MULTIPLE ACCESS COMMUNICATION NETWORK BASED ON ADAPTIVE ARRAYS
S. Zohar *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 118-127 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N81-27494*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FREQUENCY AND TIMING SYSTEM FOR THE CONSOLIDATED DSN AND STDN TRACKING NETWORK
Richard C. Coffin, Donald E. Johnson, and Paul F. Kuhnle *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 591-614 (For primary document see N81-27467 18-36)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 17B

N81-27496*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SOURCE STRUCTURE ERRORS IN RADIO-INTERFEROMETRIC CLOCK SYNCHRONIZATION FOR TEN MEASURED DISTRIBUTIONS
J. B. Thomas *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 635-645 refs (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 20N

N81-27502*# Frequency Electronics, Inc., New Hyde Park, N.Y.
THE NATO 3% MHz DISTRIBUTION SYSTEM
A. Vulcan and M. Bloch *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 743-764 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 17B

N81-27503*# Frequency Electronics, Inc., New Hyde Park, N.Y.
THE SA-2239/WLQ-4(V) CUTTY SARK DISTRIBUTION SYSTEM
Alfred Vulcan and John Ho *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval. and Planning Mar. 1981 p 765-783 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 09C

N81-27506*# National Physical Lab., New Delhi (India).
SOME NEW RESULTS ON THE FREQUENCY CHARACTERISTICS ON QUARTZ CRYSTALS IRRADIATED BY IONIZING AND PARTICLE RADIATIONS
Harish Bahadur and R. Parshad *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 829-849 refs (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 20N

N81-28040# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EXPERIMENTAL STUDY OF MULTIPLE PATHS BY A BISTATIC METHOD OF SYNTHETIC APERTURE
Dominique Medynski, Joel Fritz, and Jacques Dorey *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1981-1, Jan. - Feb. 1981 (ESA-TT-693) May 1981 p 9-13 Transl. by ONERA into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris), no. 1981-1, Jan. - Feb. 1981 (For primary document see N81-28038 18-99)
Avail: NTIS HC A04/MF A01; original FRENCH report available at ONERA, Paris FF 45

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N81-27395* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
POWER FACTOR CONTROL SYSTEM FOR ac INDUCTION MOTORS Patent
F. J. Nola, inventor (to NASA) Issued 5 May 1981 8 p Filed 1 Jun. 1979 Supersedes N79-25315(17 - 16, p 2121)
(NASA-Case-MFS-23988-1; US-Patent-4,266,177;
US-Patent-Appl-SN-044431; US-Patent-Class-318-810;
US-Patent-Class-318-799; US-Patent-Class-307-252UA) Avail: US Patent and Trademark Office CSCL 09C

A power control circuit for an induction motor is disclosed in which a servo loop is used to control power input by controlling the power factor of motor operation. The power factor is measured by summing the voltage and current derived square wave signals. Official Gazette of the U.S. Patent and Trademark Office

N81-27396* National Aeronautics and Space Administration. Pasadena Office, Calif.
CCD CORRELATED QUADRUPLE SAMPLING PROCESSOR Patent
Steve D. Gaalema, inventor (to NASA) (JPL, California Inst. of Technology, Pasadena) Issued 14 Apr. 1981 9 p Filed 6 Feb. 1979 Sponsored by NASA
(NASA-Case-NPO-14426-1; US-Patent-4,262,258;
US-Patent-Appl-SN-009889; US-Patent-Class-328-151;
US-Patent-Class-307-352; US-Patent-Class-307-353) Avail: US Patent and Trademark Office CSCL 09A

A correlated quadruple sampling processor for improved signal-to-noise ratio in the output of a charge-coupled device (CCD) is comprised of: switching means for momentarily clamping a CCD signal line at a first reference level A before a CCD data pulse and then obtaining a first data sample B with respect to the reference A during a CCD data pulse, and storing the positive sample B-A; switching means for momentarily clamping the CCD signal line a second time at the level C during the presence of the CCD data pulse and then obtaining a second data sample D with respect to the reference level C after the CCD data pulse, and storing the negative sample D-C; and means for obtaining the difference between the stored samples +(B-A) and -(D-C), thus increasing the net signal amplitude by a factor of about 2 while the noise would be increased by only a factor of square root of 2 since there will be no correlation in the noise between the double samples +(B-A) and -(D-C) effectively added. Official Gazette of the U.S. Patent and Trademark Office

N81-27397* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SHIELDED CONDUCTOR CABLE SYSTEM Patent
Kent D. Castle, inventor (to NASA) Issued 28 Apr. 1981 4 p Filed 30 Nov. 1976 Supersedes N77-13338 (15 - 04, p 0465)
(NASA-Case-MSC-12745-1; US-Patent-4,264,940;
US-Patent-Appl-SN-746579; US-Patent-Class-361-91;
US-Patent-Class-179-78; US-Patent-Class-333-12;
US-Patent-Class-361-56) Avail: US Patent and Trademark Office CSCL 09A

A cable system carries one or more insulated conductors completely enclosed within a shield having one end connected to ground. A lightning protector network connects the other end of the shield to ground. The protector network is normally open circuited and becomes only short circuited in response to a momentary abnormal surge voltage induced in the shield. The protector network's open to short impedance change completes a conductive circuit path between the shield and the two grounded ends for conducting a shield current which has the desired effect of protecting the signal carrying conductors in the cable from the large surge voltage.

Official Gazette of the U.S. Patent and Trademark Office

N81-27398 British Library Lending Div., Boston Spa (England).
THE EFFECT OF A CLOSED CAVITY IN A DIELECTRIC ON THE ELECTRIC FIELD DISTRIBUTION AND THE ONSET AND DEVELOPMENT OF PARTIAL DISCHARGE
F. Tanasescu Mar. 1981 13 p refs Transl. into ENGLISH of Electrotchnica (USSR), v. 19, no. 1, Jan. 1980 p 1-6
(BLL-RTS-12529) Avail: British Library Lending Div., Boston Spa, England

Experimental work has shown that the shape and position of cavities formed in a dielectric can exercise well defined influence on the establishment and development of aprtial discharge. The model using an electrolytic bath was shown various distributions of potential depending on the structure of the cavity. In this case there is a position and shape of cavity which can favor and intensify discharge. Measurement of the level of perturbation produced by partial discharge in such shapes of cavity show agreement with the conclusions drawn from the model using the electrolytic bath. For cavities with axis parallel to the field and for those with axis perpendicular to it, change of position relative to the electrode does not lead to a change of distribution of the field and correspondingly in the level of partial discharge, characteristic of any type of cavity. E.D.K.

N81-27399 British Library Lending Div., Boston Spa (England).
WHAT IS QUADRANT OPERATION?

G. Basedow Jan. 1981 17 p refs Transl. into ENGLISH from A M. and R. Fachberichte (West Germany), Jan. - Feb. 1978 p 13-16
(BLL-RTS-11989) Avail: British Library Lending Div., Boston Spa, England

The concept of multiquadrant operation is discussed in terms of speed torque characteristics for both power and operating machinery. The load characteristics show four typical trends which can be described by one equation. Motor characteristics are classified into four cases: series and shunt varieties. Motors which by their design show these types of behavior are regarded as special cases of industrial drives. The characteristics of piston engines and turbines are discussed. E.A.K.

N81-27400 British Library Lending Div., Boston Spa (England).
TRANSIENT PROCESSES DURING THE PROTECTION OF SERIES CONDENSERS
F. Noack Feb. 1981 31 p refs Transl. into ENGLISH from Wiss. Z. Hochsh. fuer Electrotek Ilmenau (East Germany), v. 7, no. 1 p 41-48
(BLL-RTS-12169) Avail: British Library Lending Div., Boston Spa, England

The transient process and the damping resistance limiting values derived from it were investigated. Series condensers in a train of high voltage circuits are protected against hazardous operating frequency of low frequency overvoltages by parallel connected bridging devices. A bridging device that is as quick acting as possible must be activated and its function is to relieve the series condenser from overcurrent and thereby from overvoltage. To suppress the compensating current which occurs in the bridging device parallel connection, a damping resistance is built into the bridging circuit. The size of the bridging device on a 10 kV series condenser installation and the most effective damping resistance is examined. E.A.K.

N81-27401*# Raytheon Co., Waltham, Mass. Microwave and Power Tube Div.
DESIGN DEFINITION OF A MICROWAVE POWER RECEPTION AND CONVERSION SYSTEM FOR USE ON A HIGH ALTITUDE POWERED PLATFORM
William C. Brown May 1981 92 p refs
(Contract NAS6-3006)
(NASA-CR-156866) Avail: NTIS HC A05/MF A01 CSCL 09C

The design definition of a microwave power reception and conversion system for use on high altitude powered platform is presented. The study includes an initial design, construction and test effort on a thin film, printed circuit rectenna. A study of a low altitude demonstration of an airborne rectenna was made starting with the assumption that a fifty foot mechanically steerable parabolic reflector at the Wallops Flight Center would be retrofitted with a low microwave power source consisting of a five kilowatt commercially available magnetron and that a small blimp would be used to support the rectenna. S.F.

N81-27402*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COMBINATIONAL LOGIC FOR GENERATING GATE DRIVE SIGNALS FOR PHASE CONTROL RECTIFIERS Patent Application
Carlisle R. Dolland (Garrett Corp., Los Angeles) and Daniel W. Trimble, inventors (to NASA) (Garrett Corp., Los Angeles) Filed 30 Jun. 1981 21 p Sponsored by NASA
(NASA-Case-MFS-25208-1; US-Patent-Appl-SN-280154) Avail: NTIS HC A02/MF A01 CSCL 09A

Control signals for phase delay rectifiers, which require a variable firing angle that ranges from 0 to 180 deg are derived from line to line 3 phase signals and both positive and negative firing angle control signals which are generated by comparing current command and actual current. Line to line phases are transformed into line to neutral phases and integrated to produce 90 deg phase delayed signals that are inverted to produce three cosine signals, such that for each its maximum occurs at the intersection of positive half cycles of the other two phases which are inputs to other inverters. At the same time, both positive and negative (inverted) phase sync signals are generated for each phase by comparing each with the next and producing a squarewave when it is greater. Ramp, sync and firing angle control signals are then used in combinational logic to generate the gate firing control signals for SCR gate drives which fire SCR devices in a bridge circuit. NASA

N81-27403*# National Aeronautics and Space Administration. Pasadena Office, Calif.
PROGRAMMABLE SCAN/READ CIRCUITRY FOR CHARGE COUPLED DEVICE IMAGING DETECTORS Patent Application
Phil M. Salomon (JPL, California Inst. of Technology, Pasadena) and Kalman Smilowitz, inventors (to NASA) (JPL, California Inst. of Technology, Pasadena) Filed 24 Jun. 1981 26 p
(NASA-Case-NPO-15345-1; US-Patent-Appl-SN-276749) Avail: NTIS HC A03/MF A01 CSCL 09A

A circuit is disclosed for scanning and outputting the induced charges in a solid state charge coupled device (CCD) image detector for use in a spacecraft attitude control system. The image detection system includes timing control circuitry for selectivity controlling the output of the CCD detector so that video outputs are provided only with t to induced charges correspondin to predetermined sensing element lines of the CCD detector. The system also includes an analog to digital converter for converting selected video outputs from the CCD detectoro. The timing control circuit and the analog to digital converter are controlled by a programmed microprocessor which defines the video outputs to be converted and further controls the timing control circuit so that no video outputs are provided during the delay associated with analog to digital conversion. NASA

N81-27404*# Ball Aerospace Systems Div., Boulder, Colo.
PERFORMANCE, OPERATIONAL LIMITS, OF AN ELECTRONIC SWITCHING SPHERICAL ARRAY (ESSA) ANTENNA Final Report, Aug. 1977 - Jun. 1979
Ron Stockton 2 Jul. 1979 96 p refs
(Contract NAS5-24268)
(NASA-CR-166680; F79-08) Avail: NTIS HC A05/MF A01 CSCL 09A

The development of a microprocessor controller which provides multimode operational capability for the Electronic Switching Spherical Array (ESSA) Antenna is described. The best set of operating conditions were determined and the performance of an ESSA antenna was demonstrated in the following modes: (1) omni; (2) acquisition/track; (3) directive; and (4) multibeam. The control algorithms, software flow diagrams, and electronic circuitry were developed. The microprocessor and control electronics were built and interfaced with the antenna to carry out performance testing. The acquisition/track mode for users in the Tracking and Data Relay Satellite System is emphasized. E.A.K.

N81-27405*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
THE SMART MIL-STD-1553 BUS ADAPTER HARDWARE MANUAL Interim Report
Tu. T. Ton Apr. 1981 22 p refs
(Contract NAS9-15800)
(NASA-CR-161016; JSC-17075; LEMSCO-16030) Avail: NTIS HC A02/MF A01 CSCL 09A

The SMART Multiplexer Interface Adapter, (SMIA) a complete system interface for message structure of the MIL-STD-1553, is described. It provides buffering and storage for transmitted and received data and handles all the necessary handshaking to interface between parallel 8-bit data bus and a MIL-STD serial bit stream. The bus adapter is configured as either a bus controller of a remote terminal interface. It is coupled directly to the multiplex bus, or stub coupled through an additional isolation transformer located at the connection point. Fault isolation resistors provide short circuit protection. E.A.K.

N81-27406*# Texas A&M Univ., College Station. Dept. of Electrical Engineering.
X-RAY TOPOGRAPHY STUDY OF COMPLEX SILICON MICROCIRCUITS Final Report
D. L. Parker Apr. 1981 23 p
(Contract NAS8-33519)
(NASA-CR-161815) Avail: NTIS HC A02/MF A01 CSCL 09C

The correlation between the yield of silicon microcircuits

wafers versus defects observed in X-ray topographs produced by a high speed curved wafer X-ray topographic camera was investigated. Most of the topographs were made after final wafer probe. Results indicated that most high volume silicon wafer processing does not need X-ray topography as a routine process control. It is further indicated that in changing any existing process or developing a new process the technique can be of significant benefit. R.C.T.

N81-27407# Aeronautical Research Labs., Melbourne (Australia).
THE PRODUCTION OF PRINTED CIRCUIT BOARDS, PHOTO-ANODISED AND SCREEN PRINTED INSTRUMENT PANELS
B. F. Porritt Jan. 1981 44 p
(AD-A099587; ARL-ENG-FAC-TM-5; AR-002-255) Avail: NTIS HC A03/MF A01 CSCL 09/1

This note explains in detail, the manufacturing procedures adopted at A.R.L. for the production of single-sided, double-sided and through-hole plated printed circuit boards and anodised, photo-etched and screen-printed instrument panels. All manufacturing procedures, some original, were adopted only after extensive investigation and experimentation as to their compatibility with the small batch requirements of A.R.L. Although the principal reason for the publication of this tech. memo. is for the use of personnel within A.R.L., the information may be of use to others intending to set up their own facilities for the manufacture of printed circuit boards. GRA

N81-27408# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
CIRCUITLESS ELECTRON BEAM AMPLIFIER (CEBA)
L. J. Jasper, Jr. and C. M. DeSantis Mar. 1981 47 p refs
(DA Proj. 1L1-62705-AH-94)
(AD-A099714; DELET-TR-81-8) Avail: NTIS HC A03/MF A01 CSCL 09/1

A study is presented for a high power microwave/millimeter wave amplifier (herein called CEBA) that requires no radio frequency (RF) circuit structure. The electron beam is treated as an active dielectric serving the dual purpose of slow-wave circuit and amplification source. Amplification is obtained when beam-wave synchronism is met. The RF wave, generated by an antenna, propagates inside an oversized waveguide and interacts with a solid or hollow electron beam that guides the RF energy. Two theories are presented for achieving an electron beam with isotropic permittivity and permeability characteristics. The electron beam and magnetic field parameters for obtaining this isotropic condition are given and the importance of the cyclotron frequency and Doppler effect are described for achieving low voltage and low magnetic field operation. The RF field that can propagate on the electron beam is characterized by the electric field equal to the magnetic field multiplied by the intrinsic impedance and the imaginary j phase factor. The boundary value problem is solved with emphasis on solutions for the lowest order mode. Computer generated design data show the propagation constant and growth factor as functions of frequency for selected values of plasma and cyclotron frequencies; bandwidth characteristics; and beam parameters. GRA

N81-27409# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
THE REDUCTION OF SULFURYL CHLORIDE AT TEFLON-BONDED CARBON CATHODES
S. Gilman and W. Wade, Jr. Jan. 1981 30 p refs
(DA Proj. 1L1-62705-H-941)
(AD-A100042; DELET-TR-81-2) Avail: NTIS HC A03/MF A01 CSCL 09/1

Polarization and discharge curves were measured for sulfuryl chloride reduction at Teflon-bonded carbon cathodes fabricated using a number of different carbon powders. Lithium chloroaluminate was utilized as electrolyte solute. At moderate current densities, cathode polarization tends to normalize with respect to Brunauer, Emmett, Teller (B.E.T.) surface area of the carbon. Cathode life increases with increased porosity of the electrode. The porosity is required for good accommodation of product LiCl. A formulation incorporating both high B.E.T. area and porosity was developed and found to provide good electrochemical performance against lithium counter-electrodes. When sulfuryl chloride is reduced at the optimized cathode (against a lithium anode), the main products of reaction are LiCl (which is quantitatively) deposited within the electrode's pores) and SO_2. This suggests the overall cell reaction: 2 Li-SO_2Cl_2 yields 2 LiCl-SO_2. The addition of Cl_2 or SO_2 to the electrolyte causes decrease or increase of cathode polarization, respectively. This may be taken as evidence that the reduction, at moderate current densities, occurs through a Cl_2 intermediate resulting from heterogeneous decomposition of SO_2Cl_2. Reduction of undissociated SO_2Cl_2 may occur at high current densities or after the active area of the electrode is significantly reduced through deposition of product LiCl. GRA

N81-27410# Edgerton, Germeshausen and Grier, Inc., Salem, Mass. Electronic Components Div.
INSTANT START THYRATRON SWITCH Interim Triannual Report, 1 Sep. 1980 - 1 Jan. 1981
Rodney Petr and Spencer Merz Fort Monmouth, N.J. Army Electronics Research and Development Command May 1981 29 p refs
(Contract DAAK20-79-C-0270)
(AD-A099754; DELET-TR-79-0270-3; ITR-4) Avail: NTIS HC A03/MF A01 CSCL 09/1

Efforts into developing an instant-start thyratron that requires no external heater power are described. Design work on the envelope assembly and cathode structure are basically complete, but an adequate solution to a passive reservoir has not been achieved. These problems and possible solutions are addressed. Author (GRA)

N81-27411# International Rectifier Corp., El Segundo, Calif. Semiconductor Div.
ELECTRICAL AND RELIABILITY CHARACTERIZATION OF SCHOTTKY POWER DIODES Final Technical Report, Jan. 1979 - Oct. 1980
Frank M. Gift, Dave Yarbrough, Monty Koslover, Dave Borst, and Brian Pelly Griffiss AFB, N.Y. RADC Apr. 1981 207 p
(Contract F30602-79-C-0009; AF Proj. 2338)
(AD-A099521; RADC-TR-81-38) Avail: NTIS HC A10/MF A01 CSCL 09/1

This program examined the barrier materials which were available in late 1978. Screening, electrical characterization and step stress testing were performed on six different processes power Schottky rectifiers. The proposed drafts of MIL-S-19500 detail specifications were prepared as part of this project. The data, proposed limits and related discussions are presented in this report. Author (GRA)

N81-27412# California Univ., Berkeley. Lawrence Berkeley Lab.
INTERFACE BETWEEN A PRINTED CIRCUIT BOARD COMPUTER AIDED DESIGN TOOL (TEKTRONIX 4051 BASED) AND A NUMERICAL PAPER TAPE CONTROLLED DRILL PRESS (SLO-SYN 530 - 100 WITH DUNMORE AUTOMATIC HEAD NO. 8391
Bradford K. Heckman and Victor K. Chinn Jan. 1981 39 p refs
(Contract W-7405-eng-48)
(LBL-12041) Avail: NTIS HC A03/MF A01

The development and use of computer programs written to produce the paper tape needed for the automation, or numeric control, of drill presses employed to fabricate computed-designed printed circuit boards are described. A resource is provided which allows for the increase productivity of printed circuits boards. DOE

N81-27413# Oak Ridge National Lab., Tenn.
PRECISION TRIANGULAR WAVEFORM GENERATOR MODEL 79-11965
T. R. Mueller May 1981 43 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7311) Avail: NTIS HC A03/MF A01

A signal generator is described that will produce a quasitriangular waveform that is reproducible over long periods of time. Each of the two side of the triangle that represent amplitude are linear with respect to time, but the apexes are not points because of finite system response. The ascending and descending slopes are independently selectable. The high precision arises from the use of low drift amplifiers and low temperature coefficient

components. Amplitude time jitter is less than + or - 10 sigma for periods of several hours. A circuit description, operating procedures and instructions, a checkout and test procedure, circuit diagrams, and photographs are included. DOE

N81-27414# Sandia Labs., Albuquerque, N. Mex.
COMPUTER-AIDED DESIGN SYSTEM FOR VLSI CIRCUITS
M. E. Daniel 1980 11 p refs
(Contract DE-AC04-76DP-00789)
(SAND-81-0448C) Avail: NTIS HC A02/MF A01

The framework for a hierarchical computer aided design (CAD) system to support very large scale integrated circuit and system design is described. The system supports both functional and physical design from initial specification and system synthesis to simulation, mask layout, verification, and documentation. The system is being implemented in phases on a DEC System 20 computer network within a user environment and supports evolutionary changes as technologies are developed and design strategies defined. DOE

N81-27415# Fondazione Ugo Bordoni, Rome (Italy).
STUDY ON THE STABILITY OF A SYNCHRONOUS GENERATOR CONNECTED TO AN INFINITE POWER NETWORK. MODELS AND LIAPUNOV FUNCTION GENERATION [STUDIO DELLA STABILITA DI UN GENERATORE SINCRONO CONNESSO AD UNA RETE DI POTENZA INFINITA. MODELLI E GENERAZIONE DI FUNZIONE DI LYAPUNOV]
Riccardo Marino and Salvatore Nicosia (Rome Univ.) Apr. 1980 37 p refs In ITALIAN Sponsored in part by l'Ente Nazionale Energia Electricca
(FUB-9-1980) Avail: NTIS HC A03/MF A01

The Liapunov direct method is used to determine the stability of interconnected generators. A detailed mathematical model is examined. The problem of identifying singularities is discussed. Methods for deducing the Liapunov functions are described. A particular Liapunov function is proposed for the above mentioned mathematical model. It is shown that this function includes as special cases most of the functions already proposed in the literature. Author (ESA)

N81-27416# Marconi Space and Defence System Ltd., Stanmore (England).
SUSCEPTANCE MEASUREMENTS
C. Radcliffe Paris ESA Nov. 1980 135 p
(Contract ESTEC-3270/77-NL/AK)
(F/P/102; ESA-CR(P)-1408) Avail: NTIS HC A07/MF A01

Iris susceptance measurements in circular cavities of diameters considered suitable for the realization of dual mode TE111 filters were performed. Measurements were made at 4 GHz, 17.55 GHz and at a range of frequencies around 11.2 GHz. The coupled cavity method was used for testing. Techniques for tuning both cavities to the same frequency are described. Irises were of the crossed slot type with some single slots and circular holes to provide reference and calibration data. In one case two different widths were used to provide a wider range of susceptance values. Results are normalized to B lambda c/z lambda g to allow use of the data in designing iris susceptances at any frequency by scaling the dimensions to an accuracy of 49%. Author (ESA)

N81-27417# Ente Nazionale per l'Energia Electtrica, Rome (Italy). Direzione degli Studi e Ricerche.
AN ARC FURNACE POWER SUPPLY AND EVALUATION OF THE CORRESPONDING FLICKER DISTURBANCE INTRODUCED IN THE NETWORK
Giampiero Nicola, Pier Luigi Noferi, and Paolo Papini Jan. 1978 48 p refs In ITALIAN; ENGLISH summary
(ENEL-361) Avail: NTIS HC A03/MF A01

The interference which an arc furnace may cause in electrical networks, particularly voltage drops (flicker), are reviewed. On the basis of experimental data, a criterium for estimating interference attributed to an arc furnace is given, starting with the short circuit conditions at the connection point. A computer program for the evaluation of the greatest value of the arc furnace power admisable at a network mode is also presented. Author (ESA)

N81-27418# Ente Nazional per l'Energia Elettrica, Milan (Italy). Centro di Ricerca Elettricca.
SHORT CIRCUIT PARAMETERS FOR LINE FAULTS: STATISTICAL ANALYSIS IN A HIGH VOLTAGE NETWORK
C. Galvao (Sao Paolo Univ., Brazil), U. Magagnoli, and G. Nicola Mar. 1980 32 p In ITALIAN; ENGLISH summary
(ENEL-366) Avail: NTIS HC A03/MF A01

The short circuit current and the time constant of the unidirectional current component in line faults occurring in a 388 - 220 KV transmission network and a regional 132 KV subtransmission network were investigated statistically. Distribution and typical parameters are given for single phase to ground, phase to phase, and three phase faults. The knowledge of the effective probability distribution of short circuit parameters can be used for a less conservative design of the power station components. A method for evaluating the actual short circuit current distribution, starting from distribution of bus-bar short circuit data and line lengths, is outlined. Author (ESA)

N81-27419# Engins Matra, Velizy (France).
ENAMELED STEEL SUBSTRATES FOR HYBRID CIRCUITS: BIBLIOGRAPHICAL SYNTHESIS [CIRCUITS HYBRIDES SUR TOLE EMAILLEE: SYNTHESE BIBLIOGRAPHIQUE]
P. Lautier 8 Oct. 1979 13 p refs In FRENCH
Avail: NTIS HC A02/MF A01

, A synthesis of information, available through the literature, on production technology for thick film circuits on enameled substrates is presented. Low carbon steel substrates are considered, emphasizing forming techniques and surface preparation. Different enamels are discussed, and enameling methodology is reviewed. The physical qualities of enameled substrates are mentioned, i.e., electrical characteristics and thermal resistance. The composition and development of frits are also covered. Author (ESA)

N81-27420# AEG-Telefunken, Frankfurt am Main (West Germany). Forschungsinst.
RELIABILITY STUDIES, CONSTRUCTION AND TEST OF A PILOT CABLE INSTALLATION WITH SUPERCONDUCTORS Final Report
Hermann Franke Bonn Bundesministerium fuer Forschung und Technologie Nov. 1980 228 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie Prepared in cooperation with Kabel u. Metallwerke Gutehoffnungshuette AG and Linde AG
(BMFT-FB-T-80-050; ISSN-0340-7608;
BMFT-03E4036A/ETS0003A) Avail: NTIS HC A11/MF A01

A high voltage, superconducting, flexible cable was developed, and a demonstration cable segment was constructed. Both the electrical insulation, and the current carrying capacity of suprconductors were investigated. Relative to cryogenic design requirements, thermal insulation was characterized as well as the contraction behavior of foils in a low temperature environment. Results show that the line withstands the operating voltage (550 kV, 16 mA), while the cable terminals fail. The cooling system for a larger cable installation is also described. Author (ESA)

N81-27421# Siemens A.G., Erlangen (West Germany). Research Lab.
HIGH FIELD SUPERCONDUCTORS FOR SUPERCONDUCTING MACHINES Final Report
Guenter Rupp, Manfred Wilhelm, Karl Wohlleben, Guenther Ziegler, and Englebert Springer (Vacuumschmelze GmbH) Bonn Bundesministerium fuer Forschung und Technologie Nov. 1980 151 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-069; ISSN-0340-7608) Avail: NTIS HC A08/MF A01

High current capacity Nb3Sn multifilament conductors were fabricated. A solid state diffusion process was used. The number of conductor filaments approaches 70,000 with filament diameters being approximately 1.5 microns. Effective current densities reach 86,000 A/sq cm at a magnetic flux density of 10 T and operating temperature of 4.2 K. Calibrated flattened cables of twisted strands were fabricated for higher currents (up to 1000 A at 10 T). Generally, quantitative relations can be given for the rise in the critical current of Nb3Sn multifilament conductors, observed

under the influence of mechanical stresses. Long lengths (km) of these conductors were used to manufacture superconducting solenoids two different ways. These rise to the short sample current, usually without conditioning, and deliver magnetic flux densities up to 14 T with an 8.5 T NbTi background field.
Author (ESA)

N81-27422# Siemens A.G., Erlangen (West Germany). Research Lab.
SUPERCONDUCTING ac CABLE Final Report
Fritz Schmidt Bonn Bundesministerium fuer Forschung und Technologie Nov. 1980 353 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-074; ISSN-0340-7608) Avail: NTIS HC A16/MF A01

The components of a superconducting 110 kV ac cable for power ratings > or = 2000 MVA were developed. The cable design is of the semiflexible type, with a rigid cryogenic envelope containing a flexible hollow coaxial cable core. The cable core consists of spirally wound Nb-A1 composite wires electrically insulated by high pressure polyethylene tape wrappings. A 35 m long single phase test cable with full load terminals rated at 110 kV and 10 kA was constructed and successfully tested. The results obtained prove the technical feasibility and capability of this cable design. Author (ESA)

N81-27423# Farran Research Associates, Farnanes (Ireland).
DEVELOPMENT OF A DETECTOR/MIXER FOR OPERATION FROM 0.55 mm TO 0.75 mm Final Report
Paris ESA Jul. 1980 184 p refs
(Contract ESTEC-3747/78-NL-JS(SC))
(ESA-CR(P)-1412) Avail: NTIS HC A09/MF A01

Ultra low capacitance Schottky diodes with a cutoff frequency in excess of 6,000 GHz were incorporated into two corner cube mixers optimized for operation in the 300 to 400 GHz band and the 400 to 500 GHz band. The mixer design concept is readily scalable to 1,500 GHz. Finite element analysis exposed the role of the high frequency skin effect upon diode conversion loss and resulted in the proposition of optimum chip topography for submillimeter applications. The application of a planar reactor plasma processing system to etch 1 micron anode windows in the SiO2 passivation layer resulted in the production of low capacitance (3fF) diodes with a cutoff frequency in excess of 6,000 GHz. Testing of a reveiver based on these elements and including a compact Michelson diplexer yields a receiver noise temperature of 5,300 K (DSB) at 376 GHz. Author (ESA)

N81-27424# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY OF A MICROWAVE SCANNING MECHANISM ASSEMBLY. MISMA Final Report
A. Braig, M. Granzow, H. Heimerdinger, G. Lorch, Loehle, V. Schlageter, J. Schmidt, and H. Wohnhaas Paris ESA Jun. 1980 37 p refs
(Contracts ESTEC-4111/79-NL-PP(SC); RFQ/3-3593/79-NL-PP(SC))
(DS-305-0-79; ESA-CR(P)-1415) Avail: NTIS HC A03/MF A01

The components studied include the motors and resolvers, bearings off load and locking devices, slip rings and switches. Static, thermal, alignment accuracy, and dynamic analyses are presented. Friction and lubrication, power requirements, control and instrumentation, torque noise and speed jitter analyses are included. Stability of angular rotation, shaft pointing stability and signal and power transfer were investigated. Torque interaction, reliability, electromagnetic compatibility and grounding considerations are presented. Author (ESA)

N81-27425# Selenia S.p.A., Rome (Italy). Space Activities Div.
EVALUATION AND ASSESSMENT OF LOW NOISE PREAMPLIFIERS FOR INFRARED DETECTORS Final Report
E. Antonucci and V. Tentoni Paris ESA 20 Oct. 1980 102 p refs
(Contract ESTEC-4088/79-NL-PP(SC))
(ESA-CR(P)-1418) Avail: NTIS HC A06/MF A01

Detector families and characteristics, interfaces, market availability, preamplifier design, and electrical and mechanical performance were examined for preamplifiers to be interfaced with IR detectors in the 8 to 12 micron range. Intrinsic photon detectors only are considered. Electrical characteristics for available low noise semiconductors are summarized. Several circuit configurations were assembled and tested, and results of crosstalk and electromagnetic compatibility tests presented. Circuit diagrams and components lists are given. Author (ESA)

N81-27136*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SECOND-GENERATION X/S FEEDCONE: CAPABILITIES LAYOUT, AND COMPONENTS
J. R. Withington *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 97-103 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

N81-27137*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
IMPROVED COOLING DESIGN FOR HIGH POWER WAVEGUIDE SYSTEM
W. C. J. Chen and R. Hartop *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 104-107 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

N81-27138*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AN EVALUATION OF THE INTEL 2920 DIGITAL SIGNAL PROCESSING INTEGRATED CIRCUIT
J. Heller *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 108-113 ref (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

N81-27139*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HIGH-POWER TRANSMITTER AUTOMATION, PART 2
M. A. Gregg *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 114-117 ref (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

N81-27148*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ELECTRICAL LOAD MANAGEMENT AT THE GOLDSTONE DSN COMPLEX
J. C. Rayburn *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 219-225 (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

N81-27477*# Frequency Electronics, Inc., New Hyde Park, N.Y.
FREQUENCY AND TIME GENERATION AND CONTROL
Martin Bloch *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 211-251 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 09C

N81-27501*# Efratom Systems Corp., Irvine, Calif.
DEVELOPMENT OF A SUB-MINIATURE RUBIDIUM OSCILLATOR FOR SEEKTALK APPLICATION
Hugo Fruehauf, W. Weidemann, and E. Jechart *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 719-742 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 09C

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N81-27426 British Library Lending Div., Boston Spa (England).
THE THEORY OF THE DESIGN OF THE VAPORIZATION EVAPORATOR AND THE HEAT EXCHANGER FOR GASES, 5
W. Niebergali Apr. 1981 12 p Transl. into ENGLISH from Handb. der Kaltetech. (West Germany), no. 7, 1959 p 304-310
(BLL-RTS-12527) Avail: British Library Lending Div., Boston Spa, England

The refrigerating capacity of an absorption refrigerator with gas circulation is theoretically examined. The formula for calculating refrigerating capacity per kg of effective ammonia refrigerant is presented. The evaporation process is represented in an i,y diagram for ammonia-hydrogen mixtures. The diagram and the method for determining the performance of the evaporator using the diagram is explained. The efficiency is determined, parallel flow and counter current evaporation are analyzed, and the theory and calculation of The absorber and heat exchanger are presented. J.D.H.

N81-27427*# National Aeronautics and Space Administration, Washington, D. C.
COMPUTATION OF THE SHOCK-WAVE BOUNDARY LAYER INTERACTION WITH FLOW SEPARATION
P. Ardonceau, Th. Alziary (Poitiers Univ.), and D. Aymer Dec. 1980 37 p refs Transl. into ENGLISH of "Calcul de l'Interacction Onde de Choc/Couche Limite avec Decollement" (Poitiers), 1980 p 1-34 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Centre d'Etuds Aerodynamiques et Thermiques, Poitiers (France)
(Contract NASw-3199)
(NASA-TM-75871) Avail: NTIS HC A03/MF A01 CSCL 20D

The boundary layer concept is used to describe the flow near the wall. The external flow is approximated by a pressure displacement relationship (tangent wedge in linearized supersonic flow). The boundary layer equations are solved in finite difference form and the question of the presence and unicity of the solution is considered for the direct problem (assumed pressure) or converse problem (assumed displacement thickness, friction ratio). The coupling algorithm presented implicitly processes the downstream boundary condition necessary to correctly define the interacting boundary layer problem. The algorithm uses a Newton linearization technique to provide a fast convergence. E.D.K.

N81-27428*# National Aeronautics and Space Administration, Washington, D. C.
ON THE ELECTRICAL HEATING OF WIRES IN RAREFIED GASES BY AN ELECTRIC CURRENT
Hans Busch Apr. 1981 49 p refs Transl. into ENGLISH from Annalen der Phys. (West Germany), series 4, v. 64, no. 5, 1921 p 401-450 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76597) Avail: NTIS HC A03/MF A01 CSCL 20D

Experimental work to determine the temperature dependence of the heat loss of thin wires in hydrogen is described. An explanation for the peculiar form of the current voltage curve is provided. S.F.

N81-27429*# National Aeronautics and Space Administration, Washington, D. C.
THE MARANGONI EFFECT AND TRANSLATION OF FREE NON-DEFORMABLE DROPS
E. Chifu, I. Stan, Z. Finta, and E. Gavrila May 1981 24 p refs Transl. into ENGLISH from Revista de Chimie (Romania), v. 31, no. 8, 1980 p 765-771 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original language doc. prep. by Babes-Bolyai Univ., Cluj-Napoca (Romania)
(Contract NASw-3199)
(NASA-TM-76502) Avail: NTIS HC A02/MF A01 CSCL 20D

A model is presented for flow caused by interface tension gradients, the so called Marangoni effect, on a free, nondeformable drop. A free drop, initially at rest, undergoes a translation motion upon the action of surface flow. The experiments carried out by injecting a drop with surfactants, which induce an interface tension gradient, are in good agreement with the theoretical model proposed. Author

N81-27430*# National Aeronautics and Space Administration, Washington, D. C.
THE INFLUENCE OF A LOCAL WALL DEFORMATION ON THE DEVELOPMENT OF NATURAL INSTABILITIES IN A LAMINAR BOUNDARY LAYER
S. Burnel, Pierre Gougat, and Francoise Martin Jun. 1981 25 p refs Transl. into ENGLISH from Journal de Mecanique (France), v. 16, no. 3, 1977 p 417-439 Original language document was announced as A78-12549 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Univ. of Orleans-La Source, Orleans
(Contract NASw-3199)
(NASA-TM-76558) Avail: NTIS HC A02/MF A01 CSCL 20D

The natural instabilities which propagate in the laminar boundary layer of a flat plate composed of intermittent wave trains are described. A spectral analysis determines the frequency range and gives a frequency and the harmonic 2 only if there is a wall deformation. This analysis provides the amplitude modulation spectrum of the instabilities. Plots of the evolution of power spectral density are compared with the numerical results obtained from the resolve of the Orr-Sommerfeld equation, while the harmonic is related to a micro-recirculating flow near the wall deformation. E.A.K.

N81-27431*# National Aeronautics and Space Administration, Washington, D. C.
EXISTENCE OF A NATURAL INSTABILITY NOT PREDICTED BY THEORY AND CONNECTED TO A WALL DEFORMATION IN A LAMINAR BOUNDARY LAYER
Pierre Gougat and Francoise Martin Jun. 1981 8 p refs Transl. into ENGLISH from Comptes Rendus, Serie A - Sciences Mathematiques (Paris), v. 275, no. 18, 30 Oct. 1972 p 845-848 Original language document was announced as A73-13576 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Academie des Sciences, Paris
(Contract NASw-3198)
(NASA-TM-76559) Avail: NTIS HC A02/MF A01 CSCL 20D

Natural instability related to negative wall deformation was studied. It was shown that natural instabilities which propagate in a laminar boundary layer of a flat plate are in agreement with stability theory. It is found that if a wall has a deformation, a second frequency does exist, which is not predicted and is twice the first frequency. This second instable frequency only appears if there is a negative velocity gradient. The phenomenon is located very closely to the wall and drops off rapidly when moved away from it. E.A.K.

N81-27432*# National Aeronautics and Space Administration, Washington, D. C.
STUDY OF THE DEVELOPMENT OF NATURAL INSTABILITIES IN A LAMINAR BOUNDARY LAYER IN INCOMPRESSIBLE FLOW
Serge Burnel and Pierre Gougat Jun. 1981 7 p refs Transl. into ENGLISH from Comptes Rendus, Serie A - Sci. Math. (Paris), v. 274, no. 16, 17 Apr. 1972 p 1251-1254 Original language document was announced as A72-29784 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76560) Avail: NTIS HC A02/MF A01 CSCL 20D

Natural instabilities which are created in a laminar boundary layer and which consist of intermittent wave trains were studied. The spectral analysis of these fluctuations makes it possible to localize them in terms of frequency and to isolate their spectrum

of amplitude modulation. The variation in terms of abscissa value and ordinate value of these instabilities is compared with the results derived from the solution of the Orr-Sommerfeld equation. E.A.K.

N81-27433*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SPACE SHUTTLE ORBITER FLIGHT HEATING RATE MEASUREMENT SENSITIVITY TO THERMAL PROTECTION SYSTEM UNCERTAINTIES

Pamela F. Bradley and David A. Throckmorton Jun. 1981 41 p refs

(NASA-TM-83138) Avail: NTIS HC A03/MF A01 CSCL 20D

A study was completed to determine the sensitivity of computed convective heating rates to uncertainties in the thermal protection system thermal model. Those parameters considered were: density, thermal conductivity, and specific heat of both the reusable surface insulation and its coating; coating thickness and emittance; and temperature measurement uncertainty. The assessment used a modified version of the computer program to calculate heating rates from temperature time histories. The original version of the program solves the direct one dimensional heating problem and this modified version of The program is set up to solve the inverse problem. The modified program was used in thermocouple data reduction for shuttle flight data. Both nominal thermal models and altered thermal models were used to determine the necessity for accurate knowledge of thermal protection system's material thermal properties. For many thermal properties, the sensitivity (inaccuracies created in the calculation of convective heating rate by an altered property) was very low. R.C.T.

N81-27434*# Stanford Univ., Calif. Dept. of Mechanical Engineering.

TURBULENT BOUNDARY LAYER HEAT TRANSFER EXPERIMENTS: CONVEX CURVATURE EFFECTS, INCLUDING INTRODUCTION AND RECOVERY

T. W. Simon, R. J. Moffat, J. P. Johnston, and W. M. Kays Nov. 1980 224 p refs

(Grant NAG3-3)

(NASA-CR-164619; HMT-32) Avail: NTIS HC A10/MF A01 CSCL 20D

Heat transfer rates were measured through turbulent and transitional boundary layers on an isothermal, convexly curved wall and downstream flat plate. The effect of convex curvature on the fully turbulent boundary layer was a reduction of the local Stanton numbers 20-50% below those predicted for a flat wall under the same circumstances. The recovery of the heat transfer rates on the downstream flat wall was extremely slow. After 60 cm of recovery length, the Stanton number was still typically 15-20% below the flat wall predicted value. Various effects important in the modeling of curved flows were studied separately. These are: (1) the effect of initial boundary layer thickness; (2) the effect of freestream velocity; (3) the effect of freestream acceleration; (4) the effect of unheated starting length; and (5) the effect of the maturity of the boundary layer. Regardless of the initial state, curvature eventually forced the boundary layer into an asymptotic curved condition. The slope, minus one, is believed to be significant. A.R.H.

N81-27435*# Westinghouse Research and Development Center, Pittsburgh, Pa.

HEAT PUMP PROCESSES INDUCED BY LASER RADIATION Final Report, 15 Oct. 1978 - 30 Apr. 1980

M. Garbuny and T. Henningsen 3 Jun. 1980 43 p refs

(Contract NAS2-10078)

(NASA-CR-166205) Avail: NTIS HC A03/MF A01 CSCL 20D

A carbon dioxide laser system was constructed for the demonstration of heat pump processes induced by laser radiation. The system consisted of a frequency doubling stage, a gas reaction cell with its vacuum and high purity gas supply system, and provisions to measure the temperature changes by pressure, or alternatively, by density changes. The theoretical considerations for the choice of designs and components are dicussed. R.C.T.

N81-27436# Dynamics Technology, Inc., Torrance, Calif.

SELF-INDUCED SEPARATION OF FLOW IN A HYDRODYNAMIC SCOOP

Gustave Hokenson Jul. 1980 57 p refs Backup document for AIAA Synoptic scheduled for publication in Journal of Hydronautics

(LOG-H543) Avail: NTIS HC A04/MF A01

Flow through a hydrodynamic scoop which imparts an angular deflection to the oncoming fluid stream is studied. The analytical model which is developed proposes strongly interacting, yet distinct, inviscid and boundary layer flow structures. Analysis is carried out for two dimensional flows and simplified to the point where approximate closed form results can be obtained. Theoretical prediction of the optimal scoop configuration and efficiency is obtained as a function of the fluid stream deflection angle, entrance Reynolds number, and scoop length scale. Several crucial flow field phenomena are exposed, the most significant of which is the tendency for the flow coherence to degenerate into a spray field at the point of optimal efficiency when self induced flow separation is established within the scoop. A generalized length scale correlation parameter is utilized to extend the two dimensional model to accurately predict the experimental performance and spray transition boundary of optimal three dimensional scoops. E.D.K.

N81-27437# Aeronautical Research Associates of Princeton, Inc., N. J.

LONG INTERNAL WAVES OF MODERATE AMPLITUDES. 1: SOLITONS

Harvey Segur and J. L. Hamack (California Univ., Berkeley) May 1981 49 p refs

(Contract N00014-80-C-0048)

(AD-A099729; ARAP-TM-81-8) Avail: NTIS HC A03/MF A01 CSCL 20/4

The Korteweg-deVries (KdV) equation and the finite-depth equation of Joseph (1977) and Kubota, Ko and Dobbs (1978) both describe the evolution of long internal waves of small but finite amplitude, propagating in one direction. In this paper, both theories are tested experimentally by comparing measured and theoretical soliton shapes. The KdV equation predicts the shapes of our measured solitons with remarkable accuracy, much better than does the finite-depth equation. When carried to second-order, the finite-depth theory becomes about as accurate as (first-order) KdV theory for our experiments. However, second-order corrections to the finite-depth theory also identify a bound on the range of validity of that entire expansion. This range turns out to be rather small; it includes only about half of the experiments reported by Koop and Butler (1981). Author (GRA)

N81-27438# Aeronautical Research Associates of Princeton, Inc., N. J.

LONG INTERNAL WAVES OF MODERATE AMPLITUDE. 2: VISCOUS DECAY OF SOLITARY WAVES

C. Leone (Hingham High School, Mass.) and Harvey Segur May 1981 18 p refs

(Contract N00014-80-C-0048)

(AD-A099752; ARAP-TM-81-9) Avail: NTIS HC A02/MF A01 CSCL 20/4

We derive a formula for the viscous decay of long internal solitary waves that propagate into a quiescent fluid in a two-layer model. The result is analogous to Keulegan's (1948) formula for the viscous decay of long surface waves. The requirement that the fluid ahead of the wave be quiescent is important, and we show experimentally that the accuracy of the formula decreases significantly if the internal waves are preceded by faster-traveling surface waves. Author (GRA)

N81-27439# Army Troop Support and Aviation Materiel Readiness Command, St. Louis, Mo.

ROTOR DYNAMIC INFLOW DERIVATIVES AND TIME CONSTANTS FROM VARIOUS INFLOW MODELS Ph.D. Thesis - Washington Univ., St. Louis

Dale M. Pitt Dec. 1980 235 p refs

(AD-A099532; TSARCOM-TR-81-2) Avail: NTIS HC A11/MF A01 CSCL 20/4

A linear, unsteady theory is developed that related transient rotor loads (thrust, roll moment, and pitch moment) to the overall

transient response of the rotor induced-inflow field. The relationships are derived from an unsteady, actuator-disc theory; and some are obtained in closed form. The theory is used to determine the effects of lift distribution and shaft angle-of-attack on the said relationships. Also, two different assumptions are used in the unsteady calculations, finally, a prescribed wake analysis is used to validate the actuator-disc theory for normal flight conditions. The results reveal both the strengths and weaknesses of previous formulations and reveal areas in which further study is needed. The most significant result is an analytic, three-degree-of-freedom inflow model that is shown to be accurate for use in the dynamic analysis of rotors.
Author (GRA)

N81-27440# Tennessee Univ., Knoxville. Dept. of Engineering Science and Mechanics.
RESEARCH ON NUMERICAL ALGORITHMS FOR THE THREE-DEMENSIONAL NAVIER-STOKES EQUATIONS. 2: DISSIPATIVE FINITE ELEMENT Interim Technical Report, 1 Oct. 1979 - 30 Sep. 1980
A. J. Baker Wright-Patterson AFB, Ohio AFWAL Feb. 1981 95 p refs
(Grant AF-AFOSR-0005-79; AF Proj. 2307)
(AD-A099562; AFWAL-TR-80-3157) Avail: NTIS HC A05/MF A01 CSCL 12/1

The objective of this research project is to derive and evaluate versatile, accurate and efficient numerical algorithms for solution of aerodynamic flowfields at large Reynolds number. The concept of a dissipative finite element algorithm has been refined and extended to solution of a complete equation set in aerodynamics. The resultant numerical results are highly encouraging with respect to shock resolution and overall performance, utilizing both a linear quadratic finite element embodiment of the theory. The theoretical formulational statement of the algorithm has been extended to a multi-dimensional description in generalized coordinates. The key efficiency feature is identification of the tensor matrix resolution of the Jacobian of the Newton algorithm for this statement. The concept of application of the continuity equation solution, as a differential constraint on the momentum equation algorithm, has been validated. The formulation is directly useful for viscous marching procedures, and with some modifications could be equally useful for a low Mach number Navier-Stokes solution algorithm.
Author (GRA)

N81-27441# Pennsylvania State Univ., University Park. Applid Research Lab.
AN EXPERIMENTAL AND AN ANALYTICAL STUDY OF THE FLOW FIELD AND HEAT TRANSFER OF A JET STIRRED BATH M.S. Thesis
Kristjan T. Gunnarsson Naval Sea Systems Command 19 Mar. 1981 100 p refs
(Contract N00024-79-C-6043)
(AD-A099575; ARL/PSU/TM-81-96) Avail: NTIS HC A05/MF A01 CSCL 20/4

The flow field and heat transfer characteristics of a jet-stirred bath are studied using a flow visualization technique and a finite-difference numerical calculation computer code. A description of water model used in the study is given. The data collection and data reduction phases of the flow visualization method are explained. A description of the TEACH-T computer code for the solution of recirculating turbulent flows (elliptic partial differential equations) is provided along with a discussion on the present state of mathematical turbulence modeling. Predictions of the variation of the film coefficient along the wall of the bath using both methods are given for jet Reynolds numbers of 43,733 and 30,261. Although the flow visualization technique did not give accurate quantitative data, its utility in qualitative studies is acknowledged. The TEACH-T computer code gave predictions correct to at least an order of magnitude.
GRA

N81-27442# Department of Energy, Bartlesville, Okla.
THREE-PHASE FLUID FLOW IN POROUS MEDIA
Erle C. Donaldson and Marshall B. Kayser Apr. 1981 27 p refs
(DOE/BETC-IC-80/4) Avail: NTIS HC A03/MF A01

A review of the literature on three phase relative permeability and a suggested unsteady state method for finite difference calculation procedure are presented. In the regions of two phase flow, with a third phase stationary, the third phase plays an important role in the resulting relative permeability relationships. Wettability has a extremely significant effect on the permeability and flow behavior of the system.
DOE

N81-27443# Virginia Univ., Charlottesville.
OPTIMAL CONTROL OF A ROTATING CYLINDER PARTIALLY FILLED WITH LIQUID Progress Report
Scott L. Hendricks and Connie K. Carrington Feb. 1981 49 p refs Prepared in cooperation with Virginia Polytechnic Inst. and State Univ.
(Contract DE-AC05-76OR-01779)
(UVA-ER-627-81U) Avail: NTIS HC A03/MF A01

When a flexible rotor is partially filled with liquid there is a range of operating speeds over which the system is unstable. Attempts to control the motion of the rotor while operating in this unstable range by adding an external control force to the system are documented. The governing equations are put in state space form and used in an optimal control (linear regulator) analysis. The governing equations for a two dimensional inviscid fluid contained in two different rotor models are developed. They give good results for the eigenvalues (frequencies and Qs). The optimal control analysis has not been completed due to numerical problems in the integration of the Riccati equation.
DOE

N81-27444# Oak Ridge National Lab., Tenn. Energy Div.
HEAT PUMP CONCEPTS FOR INDUSTRIAL USE OF WASTE HEAT
H. Perez Blanco May 1981 75 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7655) Avail: NTIS HC A04/MF A01

Heat pump systems for recovering waste heat are considered. A definition of performance based on the Second Law of Thermodynamics is presented. A high grade heat actuated cycle that uses a steam ejector and through residual heat actuated heat pumps are analyzed. A turbine compressor heat pump is presented that can attain relatively high delivery temperatures. The other two residual heat actuated concepts presented are absorption heat pumps. One operates on a closed cycle and the other on an open cycle. The open cycle operates with lower waste heat temperatures than a closed cycle, and during the heating season it may provide both process and space heat.
DOE

N81-27445# Oak Ridge National Lab., Tenn. Computer Sciences Div.
SOME NOTES ON NUMERICAL HEAT TRANSFER
A. D. Solomon and D. G. Wilson Nov. 1980 30 p refs
(Contract W-7405-eng-26)
(ORNL/CSD-65) Avail: NTIS HC A03/MF A01

Basic questions arsising in the numerical solution of heat transfer problems are discussed. The choice of time mesh size (delta t) in a finite difference computation is considered. The factors that may limit the size of delta t are discussed. In cases where a large spatial mesh is necessary, the choice of spatial steps and the physical meaning of the choice are discussed. A discrete model for a large spatial mesh size is presented. The application of artificial intelligence techniques to heat transfer calculations is considered.
DOE

N81-27446# Battelle Pacific Northwest Labs., Richland, Wash.
ANALYTICAL SOLUTIONS OF MOISTURE FLOW EQUATIONS AND THEIR NUMERICAL EVALUATION
A. G. Gibbs Apr. 1981 43 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3680) Avail: NTIS HC A03/MF A01

The role of analytical solutions of idealized moisture flow problems is discussed. Some different formulations of the moisture flow problem are reviewed. A number of different analytical solutions are summarized, including the case of idealized coupled moisture and heat flow. The evaluation of special functions which commonly arise in analytical solutions is discussed, including some pitfalls in the evaluation of expressions involving combinations of special functions. Finally, perturbation theory methods are summarized which can be used to obtain good approximate analytical solutions to problems which are too complicated to

solve exactly, but which are close to an analytically solvable problem. DOE

N81-27447# Los Alamos Scientific Lab., N. Mex.
RESTRICTIONS ON RELATIVISTICALLY ROTATING FLUIDS
Jack R. Schendel Mar. 1981 94 p refs
(Contract W-7405-eng-36)
(LA-8789-T) Avail: NTIS HC A05/MF A01

A set of inequalities which apply to the surface of rigidly rotating, perfect fluids with asymptotically flat exteriors is derived. This set consists of both algebraic inequalities and inequalities which involve integrals performed over the surface of the fluid. The physical content of these inequalities is investigated by examining the restricts they impose on the existence of rotating fluid models with Kerr interiors. For this case, the dominant set of inequalities is found and expressed in an analytic form. These restrictions impose a finite maximum redshift between observers on the surface and at infinity for all models with the Kerr parameters a > m. However, for all models with 0 < a/m less than or equal to 1, there is a unique configuration for which the redshift is unbounded. In the static limit, a (FEMALE) 0, a finite maximum redshift depending on the matter distribution of the static background is found. This result is compared to stability requirements for nonrotating fluids. The implications of this comparison and areas for future extensions are discussed. DOE

N81-27448# Los Alamos Scientific Lab., N. Mex.
TURBULENT WALL-SHEAR-STRESS FLUCTUATIONS IN FULLY DEVELOPED AND ACCELERATING FLOWS
Frank W. Chambers and Hugh D. Murphy Mar. 1981 35 p refs
(Contract W-7405-eng-36)
(LA-8781-MS) Avail: NTIS HC A03/MF A01

A heated shear stress sensor was mounted at the wall of an air flow duct, and turbulent shear stress fluctuations were measured using constant temperature anemometry and analyzed by means of conditioned sampling. The lateral side walls of the duct could be moved so that the duct span could be reduced, resulting in acceleration of the flow in the streamwise direction. For the 27 flows examined, the Reynolds number varied from 7600 to 47,200 and the dimensionless acceleration, ((MU)/V(2)) dV/ux, ranged from 0.0 to 3.4 x 10(+6), thus encompassing the full spectrum from turbulent to relaminarized flow. For the fully developed flows, i.e., those for which the acceleration was zero, the frequencies of the turbulent bursts and the times during the sweeps of the eddies toward the duct wall were independent of Reynolds number, when scaled with inner variables. When the flows were accelerated, the bursting frequencies approached zero as the dimensionless acceleration increased to 3.4 x 10(+6) however, the dimensionless value of the conditionally averaged shear stress was unaffected suggesting that acceleration did not affect the individual burst or sweep per se, but only the frequency of these events. DOE

N81-27449# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
RADIATIVE COOLING TEST FACILITY AND PERFORMANCE EVALUATION OF 4-MIL ALUMINIZED POLYVINYL FLUORIDE AND WHITE PAINT SURFACES
Mark S. Kruskopt, Paul Berdahl, Mario Martin, Fateh Sakkal, and Mark Sobolewski Nov. 1980 67 p refs
(Contract W-7405-eng-48)
(LBL-12049) Avail: NTIS HC A04/MF A01

A test facility designed to measure the amount of radiative cooling a specific material or assembly of materials will produce when exposed to the sky is described. Emphasis is placed upon assemblies which are specifically designed to produce radiative cooling and which therefore offer promise for the reduction of temperatures and/or humidities in occupied spaces. The hardware and software used to operate the facility are documented and the results of the first comprehensive experiments are presented. A microcomputer based control/data acquisition system was employed to study the performance of two prototype radiator surfaces: 4-mil aluminized polyvinyl fluoride (PVF) and white painted surfaces set below polyethylene windscreens. The cooling rates for materials tested were determined and can be approximated by an equation (given). A computer model developed to simulate the cooling process is presented. DOE

N81-27450# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
PERFORMANCE OF RESIDENTIAL AIR-TO-AIR HEAT EXCHANGERS: TEST METHODS AND RESULTS
William J. Fisk, Gary D. Roseme, and Craig D. Hollowell Sep. 1980 84 p refs
(Contract W-7405-eng-48)
(LBL-11793) Avail: NTIS HC A05/MF A01

Test results obtained on five different residential heat exchangers are presented and the performance criteria, the test facility, and the test procedures used are described. The performance parameters measured were heat exchanger effectiveness (a measure of heat transfer ability), airstream static pressure drop, net cross stream leakage, and fan system performance. Results showed the ability to transfer heat ranged from 43% to 75% of the theoretical maximum. The resistance to air flow varied by a factor of two. One of the heat exchangers was highly susceptible to leakage between airstreams and one had an unstable performance. Future plans are indicated: additional heat exchangers will be tested, a new test system will be used to measure cross stream leakage, and the possibility and consequences of freeze up within the heat exchangers will be investigated. DOE

N81-27451# Engins Matra, Velizy (France).
THE INFINITESIMAL, SECOND ORDER CHARACTER OF LOCAL MACH NUMBER VARIATIONS IN CALCULATIONS OF NOSE CONE HEATING, EITHER FROM ATHERMANOUS TEMPERATURE OR FROM THE TRANSFER COEFFICIENT FOUND WITH THE LOCAL NUSSELT NUMBER [CARACTERE INFINITESIMAL (DU SECOND ORDRE) DES VARIATIONS DU MACH LOCAL DANS LES CALCULS D'ECHAUFFEMENT D'UNE ORIGINE A PARTIR DE LA TEMPERATURE ATHERMANE ET DU COEFFICIENT D'ECHANGE TIRE DU NOMBRE DE NUESSELT LOCAL]
M. Deschamps 6 Mar. 1980 5 p In FRENCH
(N-FIT-767) Avail: NTIS HC A02/MF A01

The difference between the athermanous temperature calculated using nose cone upstream aerodynamic characteristics on the one hand, and on the other, using local aerodynamic characteristics is determined. The flow velocity is given by the St. Venant formula. The coefficient of compression on the nose cone is introduced. The calculation of the athermanous temperature is explained, and a numerical application leads to a very good second order approximation. The error is shown maximal at M = 6, given ambient temperature. It is thus unnecessary to know the local Mach numbers along a nose cone in order to calculate heating accurately. Author (ESA)

N81-27452# Essen Univ. (West Germany). Angewandte Thermodynamik und Klimatechnik.
BASIC INVESTIGATIONS ON HEAT PUMPS, PART 1 Final Report
Joachim Paul, Ulrich Pfeiffenberger, Johannes Reichelt, and Arnold Tolle Bonn Bundesministerium fuer Forschung und Technologie Dec. 1980 261 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie 2 Vol.
(BMFT-FB-T-80-163-Pt-1; ISSN-0340-7608) Avail: NTIS HC A12/MF A01

By means of measurement, calculations and comparisons of heat pump cycle are investigated with respect to heat pump applications. The use of computer programs for the determination of basic characteristics of heat pumps is discussed. The influence of electric motor cooling, lubrication, different refrigerants, speed control, and partial load behavior of heat exchangers are shown to be of special importance. For absorption heat pumps, solvent/refrigerant mixtures are studied; additional measurements for heat pump operation are described. Author (ESA)

N81-27453# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
KINETIC HEATING DUE TO A SKEWED SHOCK WAVE/TURBULENT BOUNDARY LAYER INTERACTION

Gerard Degrez Jan. 1981 49 p refs
(VKI-TN-138) Avail: NTIS HC A03/MF A01

A flat/finned plate arrangement test configuration with both a sharp and a blunt fin was studied. The plate was set at angles of incidence of 7,4, and 0 degrees relative to the wind tunnel axis providing three different Mach numbers for the undisturbed flow over the flat plate (5.00, 5.53, and 6.07). Experimental data were obtained for three different shock generator angles of incidence 5,10, and 15 degrees and for three Mach numbers. Very satisfactory pressure and heat distributions were predicted by Schuderi's method. The blunting of the fin's heading edge resulted is an outward displacement of the pressure and heat transfer distribution caused by the outward displacement of the inviscid shock wave. The peak pressure was considerably reduced and the peak pressure and peak heating positions coincided. Author (ESA)

N81-27454# European Space Agency, Paris (France).
EXPERIMENTAL INVESTIGATION OF THE PARTICLE-NUMBER CONCENTRATION IN A WIND TUNNEL FOR USE IN LASER ANEMOMETRY
Harro Bessling, Reinhard Kiock, Christoph Helsper, and Heinz Fissan Jan. 1981 47 p refs Transl. into ENGLISH of "Experimentelle Untersuchung der Partikelanzahlkonzentration im Windkanal fuer den Einsatz von Laseranemometrischen Verfahren" DFVLR, Brunswick report DFVLR-FB-79-28, Jun. 1979 Original report in GERMAN previously announced as N80-25352
(ESA-TT-647; DFVLR-FB-79-28) Avail: NTIS HC A03/MF A01

Through wake measurements the emitter positions were determined, at which no significant effect was induced by the emitter. A Draeger aerosol generator was used to produce particles, and an electrostatic aerosol analyzer to determine the particle concentrations. With continuous aerosol additions from a disturbance free emitter position (on the tunnel axis, 1.80 m distant from the working section), constant, time independent aerosol concentrations were achieved. The level of the particle number concentration dropped off sharply with increase in compressor speed and showed a weaker decrease between the tunnel center and the walls. The required minimum concentration was obtained up to speeds of rotation of around 4700 rpm.
Author (ESA)

N81-27455# Fiat Research Center, Turin (Italy).
FLUID PHYSICS MODULE: OPTIMIZATION AND IMPROVEMENT STUDY Final Report
C. Dadda, A. Mariani, R. Cerrato, R. Librino, and G. Antonucci Paris ESA 20 Sep. 1980 253 p refs
(Contract ESTEC-4054/79-NL-HP(SC))
(TSE-081-80-RV.A; ESA-CR(P)-1420) Avail: NTIS HC A12/MF A01

The engineering design performed for the purpose of converting the fluid physics module (FPM) to be flown on the first Spacelab mission, into an autonomous facility is presented. The improvements considered include 16 mm motion picture cameras and interchangeable TV, cine and still cameras, with full remote control for better recording of experiments and increased operational visibility. A high intensity parallel light beam obtained from a xenon arc lamp is proposed for better resolution and high contrast image recording. Other features considered are flash illumination operation and a Schlieren capability. The installation of an improved FPM in a Spacelab rack is considered. Author (ESA)

N81-27456# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
EUROPEAN RESEARCH PROGRAM ON VISCOUS FLOWS, 1980 Annual Report, 1980
P. D. Smith, ed., B. vandenBerg, ed. (NLR, Amsterdam), J. Cousteix, ed. (Centre d'Etudes et de Recherche de Toulouse), T. K. Fannelop, ed. (Aeronautical Research Inst. of Sweden, Bromma), and W. Kordulla, ed. (DFVLR, Goettingen, West Germany) Nov. 1980 130 p refs
(RAE-TM-Aero-1879; Eurovisc-AR-1980) Avail: NTIS HC A07/MF A01

Several investigations considering various aspects of viscous flow dynamics are summarized. The main topics include complete solutions of Navier Stokes equations, boundary transitions and separations, shockwave, interactions heat transfer, unsteady flow, corner flow, noise, generation 11 roughness effects and experimental techniques. Author (ESA)

N81-28039# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LIFTING LINE ASYMPTOTIC THEORY IN COMPRESSIBLE OSCILLATING FLOW
Jean-Pierre Guiraud (Universite Pierre et Marie Curie) and Gilles Slama (Universite Pierre et Marie Curie) *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1981-1, Jan. - Feb. 1981 (ESA-TT-693) May 1981 p 3-8 refs Transl. by ONERA into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris), no. 1981-1, Jan. - Feb. 1981 (For primary document see N81-28038 18-99)
Avail: NTIS HC A04/MF A01; original FRENCH report available at ONERA, Paris FF 45

N81-28044# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ON THE APPLICATION OF HOT-WIRE ANEMOMETRY TO THE SOLUTION OF PROBLEMS ARISING IN VARIABLE TEMPERATURE TURBULENT FLOWS
J. Gaviglio (CNRS, Marseille), J.-P. Anguillet (CNRS, Marseille), and M. Elena (CNRS, Marseille) *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1981-1, Jan. - Feb. 1981 (ESA-TT-693) May 1981 p 59-66 refs Transl. by ONERA into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris), No. 1981-1, Jan. - Feb. 1981 (For primary document see N81-28038 18-99)
Avail: NTIS HC A04/MF A01; original FRENCH report available at ONERA, Paris FF 45

N81-27154# Centre National d'Etudes Spatiales, Toulouse (France).
RADIATION [LE RAYONNEMENT]
A. Rolfo *In its* Thermal Control of Spaceborne Expts. 1981 p 5-13 refs In FRENCH (For primary document see N81-27152 18-12)
Avail: NTIS HC A07/MF A01

N81-27155# Centre National d'Etudes Spatiales, Toulouse (France).
CONDUCTIVE AND CONVECTIVE TRANSFER [LES ECHANGES CONDUCTIFS ET CONVECTIFS]
M. C. Desjean *In its* Thermal Control of Spaceborne Expts. 1981 p 15-35 refs In FRENCH (For primary document see N81-27152 18-12)
Avail: NTIS HC A07/MF A01

N81-27156# Centre National d'Etudes Spatiales, Toulouse (France).
CALCULATION OF EXTERNAL FLUX: SPACE ENVIRONMENT [CALCUL DES FLUX EXTERNES - ENVIRONNEMENT SPATIAL]
A. Rolfo and J. Mauduyt *In its* Thermal Control of Spaceborne Expts. 1981 p 37-46 refs In FRENCH (For primary document see N81-27152 18-12)
Avail: NTIS HC A07/MF A01

N81-27160# Centre National d'Etudes Spatiales, Toulouse (France).
COMPUTER PROGRAMS USED FOR TEMPERATURE CALCULATIONS [LOGICIELS UTILISES DANS LES CALCULS DE THERMIQUE]
J. F. Gory *In its* Thermal Control of Spaceborne Expts. 1981 p 97-108 refs In FRENCH (For primary document see N81-27152 18-12)
Avail: NTIS HC A07/MF A01

N81-27162# Centre National d'Etudes Spatiales, Toulouse (France).
MEANS AVAILABLE AT THE CNES FOR MEASURING THERMO-OPTICAL CHARACTERISTICS [MOYENS DE MESURE DE CARACTERISTIQUES THERMO OPTIQUES DISPONIBLES AU CNES]

B. Tatry *In its* Thermal Control of Spaceborne Expts. 1981 p 117-128 In FRENCH (For primary document see N81-27152 18-12)
Avail: NTIS HC A07/MF A01

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N81-27457 British Library Lending Div., Boston Spa (England). Article Translating Service.
OPTIMISING THE PARAMETERS OF SPECTROMETERS WITH CADMIUM-TELLURIDE DETECTORS
Milos Vidra Apr. 1981 28 p refs Transl. into ENGLISH from Jad. Energ. (Czechoslovakia), v. 25, no. 12, 1979 p 446-453 (BLL-RTS-12539) Avail: British Library Lending Div., Boston Spa, England

The influence of the principal physical and electronic factors on the resolving power of spectrometers with cadmium telluride (CdTe) detectors is examined. The influence of the operating voltage of the detector, its current component, the magnitude of the operating resistance, the parameters of the charge preamplifier, the magnitude of the time constants of the pulse shaping amplifier, the detector polarization when the operating voltage is applied, the time taken for the charge to collect at the detector electrodes and the operating temperature of the detector are studied. It was found that CdTe detectors have the advantage over scintillation detectors of better resolving power and greater thermal stability. E.A.K.

N81-27458*# Ball Aerospace Systems Div., Boulder, Colo.
CO-ALIGNMENT SYSTEM (CAS) STUDY. REPORT ON TASK 1-3 Final Report
Neal T. Anderson 17 Nov. 1980 113 p refs
(Contract NAS5-26243)
(NASA-CR-166681; F80-12) Avail: NTIS HC A06/MF A01 CSCL 14B

The design of a suitable coalignment system (CAS) for the Solar Extreme Ultraviolet Telescope and Spectrometer (SEUTS) is presented. The CAS provides offset adjustment capabilities to SEUTS which will be mounted on a single large pointing system with other devices. The suitability of existing designs is determined and modifications are suggested. M.G.

N81-27459*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD OF AND APPARATUS FOR DOUBLE-EXPOSURE HOLOGRAPHIC INTERFEROMETRY Patent Application
William K. Witherow, inventor (to NASA) Filed 17 Jun. 1981 14 p
(NASA-Case-MFS-25405-1; US-Patent-Appl-SN-274708) Avail: NTIS HC A02/MF A01 CSCL 14E

Double exposure holographic interferometry is carried out using two lasers which are responsive to respective applied firing signals for producing respective pulsed output beams. An optical system is provided which is so oriented that the output beams of the lasers produce coinciding scene and reference beams. An initiator circuit generates and applies a firing signal to the first laser and a timer/firing device, responsive to the generation of a firing signal by the initiator circuit, generates and applies a firing signal to the second laser at a predetermined period of time later. NASA

N81-27460*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
PRELIMINARY DESIGN OF THE CRYOGENIC COOLED LIMB SCANNING INTERFEROMETER RADIOMETER (CLIR) Final Report
Allan Sherman 31 May 1978 81 p refs
(Contract NAS5-24287)
(NASA-CR-166684; LMSC-D626264) Avail: NTIS HC A05/MF A01 CSCL 14B

The preliminary design of the cryogenic cooling system for the Cryogenic Cooled Limb Scanning Interferometer Radiometer (CLIR) instrument to be flown on the Atmospheric Magnetospheric Physics Satellite (AMPS) was studied. The top level trade studies were extensive due to the instrument requirement for cooling at three temperature levels as opposed to the two levels initially described for the instrument. Approximately 12 different combinations of cryogens were investigated. The basic lifetime requirement for the instrument was 30 days. However, studies were also conducted for a follow-up mission requiring a 1 year lifetime. The top level trades led to the selection of a single stage supercritical helium baseline. E.A.K.

N81-27461*# JMA, Inc., Tuscaloosa, Ala.
PINHOLE-CORONOGRAPH TRACKING CONTROL Final Report
Michael Greene 5 Jun. 1981 23 p refs
(NASA Order H-52750-B)
(NASA-CR-161819) Avail: NTIS HC A02/MF A01 CSCL 14E

The pinhole occulter system, a space shuttle based experiment for the production of hard X-ray images taken primarily from the Sun is described. The system is a pinhole camera utilizing a deployable 50 m flexible boom for separating the pinhole from the recording devices located in the shuttle. The system is subjected to the disturbances of the shuttle. The worst of these are thruster firing for orbit correction, man motion, motion induced by other systems, and gravity gradient torques. The control system of the pointing mount senses both position and velocity of the mask tip and uses these to estimate accurately the flexible modes of the system. E.A.K.

N81-27462*# Lockheed Missiles and Space Co., Palo Alto, Calif.
DEVELOPMENT AND TESTING OF 2-DIMENSIONAL PHOTON COUNTER Final Report, 12 May 1980 - 12 Feb. 1981
12 Feb. 1981 11 p
(Contract NAS2-10618)
(NASA-CR-166204; LMSC-D770635) Avail: NTIS HC A02/MF A01 CSCL 14B

The development of a commercially available two dimensional photon counter into an operational system for speckle imaging of astronomical objects is described. The system includes digital recording for field observations. The counter has a bialkali photocathode with a field size of 18 by 18 mm over which it resolves about 100 by 100 pixels. The system records photon positions as 16 bit words at rates up to 14,400 per second. Field tests at observatories verifying the operation of the system are described. J.D.H.

N81-27463# Los Alamos Scientific Lab., N. Mex.
GAS SCINTILLATION PROPORTIONAL COUNTERS
David F. Anderson 1981 22 p refs Presented at the INS meeting on Nucl. Radiation Detectors, Tokyo, 23-26 Mar. 1981
(Contract W-7405-eng-36)
(LA-UR-81-861; CONF-810351-1) Avail: NTIS HC A02/MF A01

The principle of operation of the gas scintillation proportional counter and a history of its development is presented here. Its advantages and possible applications are also considered. DOE

N81-27464# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
PRINCIPLE OF OPERATION, PERFORMANCE AND FIRST RESULTS OF THE ENERGETIC PARTICLE INSTRUMENT ON BOARD THE SUBSTORM AND PORCUPINE PAYLOAD Final Report
Wolfgang Stuedemann and Hans-Peter Winterhoff Bonn Bundesministerium fuer Forschung und Technologie Dec. 1980 45 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-80-006; ISSN-0170-1339) Avail: NTIS HC A03/MF A01

An instrument which measures the energy and pitch angle distributions of electrons and ions ($Z > or = 1$) in the tens of keV energy range is described. Electrons and ions are separated

by their different charge to mass ratio, using a homogeneous magnetic field. The particles are detected by surface barrier solid state detectors. Energy analysis is done by pulse height analysis of the outputs of the various solid state detectors, having integral level discriminators as well as differential energy passbands. Pitch angle analysis is accomplished making use of the variation in viewing angle with respect to the Earth's magnetic field near a spinning vehicle. To extend the pitch angle coverage and to obtain high time resolution, four identical electron sensors (two for protons) are mounted with different orientation angles. Results of the data obtained during the four flights within the Substorm phenomena program and from the two flights of the Porcupine program. Author (ESA)

N81-27465# Kayser Threde G.m.b.H., Munich (West Germany).
DEFINITION STUDY FOR A MICHELSON INTERFEROMETER Final Report
Peter Burkert, Wolfgang Bangert, Guenter Schmitt, Peter Zoth, Friedrich Fergg (Technische Univ., Munich), Werner Voelker (Technische Univ., Munich), and Franz Kohler (INTOP-Kollmorgen GmbH) Bonn Bundesministerium fuer Forschung und Technologie Dec. 1980 188 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-80-031; ISSN-0170-1339) Avail: NTIS HC A09/MF A01

A high resolution two-beam interferometer, proposed for the measurement of atmospheric emission spectra in the wavelength range between 5 and 15 microns is discussed. The technical concept of such an interferometer for operation on a Spacelab pallet is worked out. By analyzing the functions of the essential subsystems, the qualification of the experiment for use under space environment conditions and at low temperatures (4 K) is established. The requirement of extreme low heat load in the cryogenic chamber is met by the introduction of a modified interferometer model, the so-called pendulum interferometer. Author (ESA)

N81-27479*# KERNCO, Inc., Danvers, Mass.
INNOVATION AND RELIABILITY OF ATOMIC STANDARDS FOR PTTI APPLICATIONS
Robert Kern *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 275-280 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 20E

N81-27482*# European Space Agency, Toulouse (France).
PROGRESS OF THE LASSO EXPERIMENT
Bernard E. H. Serene *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 307-327 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 14B

N81-27483*# Istituto Elettrotecnico Nazionale (Galileo Ferraris), Turin (Italy).
TWO-WAY SEQUENTIAL TIME SYNCHRONIZATION: PRELIMINARY RESULTS FROM THE SIRIO-1 EXPERIMENT
E. Detoma and Sigfrido Leschiutta *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 329-350 refs Sponsored in part by the Italian National Research Council (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 14B

N81-27484*# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
FLIGHT AND GROUND TESTS OF A GOES SATELLITE TIME RECEIVER FOR SATELLITE COMMUNICATIONS APPLICATIONS
Roger L. Swanson and Stephen A. Nichols (Naval Research Lab., Washington, D.C.) *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 351-376 refs (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 14B

N81-27485*# Hydro-Quebec Inst. for Research, Varennes.
PTTI APPLICATIONS AT HYDRO-QUEBEC
Gills Missout, J. Beland, and G. Bedard *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 377-385 refs (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 14B

N81-27486*# Naval Observatory, Washington, D. C.
USNO GPS PROGRAM
Kenneth Putkovich *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 387-415 refs (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 14B

N81-27488*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SHORT TURN-AROUND INTERCONTINENTAL CLOCK SYNCHRONIZATION USING VERY-LONG-BASELINE INTERFEROMETRY Progress Report
George A. Madrid, Thomas P. Yunck, and R. B. Henderson *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 445-460 refs (For primary document see N81-27467 18-36)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 14B

N81-27489*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RECENT PROGRESS IN THE NASA-GODDARD SPACE FLIGHT CENTER ATOMIC HYDROGEN STANDARDS PROGRAM
Victor S. Reinhardt *In its* Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 463-493 refs (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 14B

N81-27491*# Swiss Post Office, Berne.
REFERENCE CLOCK PARAMETERS FOR DIGITAL COMMUNICATIONS SYSTEMS APPLICATIONS
Peter Kartaschoff *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 515-549 refs (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 14B

N81-27492*# Naval Surface Weapons Center, Dahlgren, Va.
AN ANALYTIC TECHNIQUE FOR STATISTICALLY MODELING RANDOM ATOMIC CLOCK ERRORS IN ESTIMATION
Patrick J. Fell *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 551-580 refs (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 14B

N81-27499*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ON ESTIMATING THE EFFECTS OF CLOCK INSTABILITY WITH FLICKER NOISE CHARACTERISTICS
Sien-Chong Wu *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 681-701 refs (For primary document see N81-27467 18-36)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 14B

N81-27507*# National Physical Lab., New Delhi (India). Time and Frequency Section.
PRECISE T AND F INTERCOMPARISON VIA VLF PHASE MEASUREMENTS
A. Sen Gupta, G. K. Goel, and B. S. Mathur *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 851-862 refs (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 14B

N81-27508*# National Physical Lab., New Delhi (India). Time and Frequency Section.
PRECISE TIME AND FREQUENCY INTERCOMPARISON BETWEEN NPL, INDIA AND PTB, FEDERAL REPUBLIC OF GERMANY VIA SATELLITE SYMPHONIE-1
B. S. Mathur, P. Banerjee, P. C. Sood, Mithlesh Saxena, Nand Kumar, and A. K. Suri *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 863-874 refs (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 14B

36 LASERS AND MASERS

Includes parametric amplifiers.

N81-27466 British Library Lending Div., Boston Spa (England).
TWO SHORT (10-12S) PULSE ANALYSIS SYSTEMS
F. Pandarese (Centro Informazioni Studi Esperienze, Milan) Jul. 1980 18 p refs Transl. into ENGLISH from Alta Frequenza (Milan), v. 47, no. 3, Mar. 1978 p 195-200
(BLL-RDL-Trans-3647-(7737.47)) Avail: British Library Lending Div., Boston Spa, England

A description is given of the two systems most commonly used for the analysis of short pulses: the optical Kerr effect shutter cell and the streak camera. Solutions to certain problems that arise with the two systems, transmission fluctuation in the case of the optical Kerr effect shutter cell and jitter of the ramp generator circuit in the case of the streak tube, are suggested and evaluated. Author

N81-27467*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROCEEDINGS OF THE 12TH ANNUAL PRECISE TIME AND TIME INTERVAL (PTTI) APPLICATIONS AND PLANNING MEETING
Schuyler C. Wardrip, ed. Mar. 1981 871 p refs Meeting held at Greenbelt, Md., 2-4 Dec. 1980 Sponsored in cooperation with Navy, NBS and Defense Communications Agency
(NASA-CP-2175; Rept-814.2) Avail: NTIS HC A99/MF A01 CSCL 14D

The meeting gave PTTI managers, systems engineers, and program planners a transparent view of the state-of-the-art, an opportunity to express needs, a view of important future trends, and a review of relevant past accomplishments. The PTTI users were provided with new and useful applications, procedures, and techniques. Emphasis is placed on military applications and avionics. For individual titles, see N81-27468 through N81-27508.

N81-27468*# Naval Material Command, Washington, D. C. Dept. of Material for Reliability and Maintainability and Quality Assurance.
MANAGEMENT OF RELIABILITY AND MAINTAINABILITY; A DISCIPLINED APPROACH TO FLEET READINESS c38
Willis J. Willoughby, Jr. *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 13-55 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 14D

Material acquisition fundamentals were reviewed and include: mission profile definition, stress analysis, derating criteria, circuit reliability, failure modes, and worst case analysis. Military system reliability was examined with emphasis on the sparing of equipment. The Navy's organizational strategy for 1980 is presented. T.M.

N81-27469*# Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
RELIABILITY ACHIEVEMENT IN HIGH TECHNOLOGY SPACE SYSTEMS c38
Dean L. Lindstrom *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 57-67 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 14D

The production of failure-free hardware is discussed. The elements required to achieve such hardware are: technical expertise to design, analyze, and fully understand the design; use of high reliability parts and materials control in the manufacturing process; and testing to understand the system and weed out defects. The durability of the Hughes family of satellites is highlighted. T.M.

N81-27470*# General Dynamics Corp., Pomona, Calif.
APPROACH TO RELIABILITY WHEN APPLYING NEW TECHNOLOGIES c38
John C. Bear *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 69-79 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 14D

Tactical weapon systems, while different in many respects from PTTI applications, face similar risks in achieving reliability in development. General principles derived from experience in achieving high reliability in tactical weapon systems are selectively summarized for application to new technologies in unusual environments. T.M.

N81-27471*# Honeywell, Inc., Minneapolis, Minn. Reliability Dept.
RELIABILITY AND THE DESIGN PROCESS AT HONEYWELL AVIONICS DIVISION c38
Alex Bezat *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 81-97 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 14D

The division's philosophy for designed-in reliability and a comparison of reliability programs for space, manned military aircraft, and commercial aircraft, are presented. Topics include: the reliability interface with design and production; the concept phase through final proposal; the design, development, test and evaluation phase; the production phase; and the commonality among space, military, and commercial avionics. T.M.

N81-27472*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A SPACE SYSTEM FOR HIGH-ACCURACY GLOBAL TIME AND FREQUENCY COMPARISON OF CLOCKS
Rudolf Decher, David W. Allan (NBS, Boulder, Colo.), Carroll O. Alley (Maryland Univ., College Park), Robert F. C. Vessot (Smithsonian Astrophysical Observatory), and G. M. R. Winkler (Naval Observatory) *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 99-111 refs (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 20E

A Space Shuttle experiment in which a hydrogen maser clock on board the Space Shuttle will be compared with clocks on the ground using two-way microwave and short pulse laser signals is described. The accuracy goal for the experiment is 1 nsec or better for the time transfer and 10 to the minus 14th power for the frequency comparison. A direct frequency comparison of primary standards at the 10 to the minus 14th power accuracy level is a unique feature of the proposed system. Both time and frequency transfer will be accomplished by microwave transmission, while the laser signals provide calibration of the system as well as subnanosecond time transfer. T.M.

N81-27473*# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.
DEPARTMENT OF DEFENSE PRECISE TIME AND TIME INTERVAL PROGRAM IMPROVEMENT PLAN
James R. Bowser *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 115-125 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 20E

The United States Naval Observatory is responsible for ensuring uniformity in precise time and time interval operations including measurements, the establishment of overall DOD requirements for time and time interval, and the accomplishment

of objectives requiring precise time and time interval with minimum cost. An overview of the objectives, the approach to the problem, the schedule, and a status report, including significant findings relative to organizational relationships, current directives, principal PTTI users, and future requirements as currently identified by the users are presented. T.M.

N81-27474*# Naval Electronic Systems Command, Washington, D. C.

A U.S. NAVY PRECISE TIME AND TIME INTERVAL (PTTI) PROGRAM UPDATE

Ralph T. Allen *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 127-140 refs (For primary document see N81-27467 18-36)

Avail: NTIS HC A99/MF A01 CSCL 20E

The review presents a brief history of the program, its management organization, and current and projected requirements, capabilities and program efforts. The overall program growth since September 1975 is presented. The Navy's areas of concern regarding future PTTI development are described. T.M.

N81-27475*# Rome Air Development Center, Hanscom AFB, Mass. Electronic Technology Directorate.

PRECISE TIME TECHNOLOGY FOR SELECTED AIR FORCE SYSTEMS: PRESENT STATUS AND FUTURE REQUIREMENTS

Nicholas F. Yannoni *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 141-150 refs (For primary document see N81-27467 18-36)

Avail: NTIS HC A99/MF A01 CSCL 20E

Precise time and time interval (PTTI) technology is becoming increasingly significant to Air Force operations as digital techniques find expanded utility in military missions. Timing has a key role in the function as well as in navigation. A survey of the PTTI needs of several Air Force systems is presented. Current technology supporting these needs was reviewed and new requirements are emphasized for systems as they transfer from initial development to final operational deployment. T.M.

N81-27476*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

NASA PTTI PROGRAMS: PRESENT AND FUTURE

Schuyler C. Wardrip and William M. Hocking *In its* Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 151-198 (For primary document see N81-27467 18-36)

Avail: NTIS HC A99/MF A01 CSCL 20E

Current and future Precise Time and Time Interval (PTTI) programs at the Goddard Space Flight Center (GSFC) and the evolution of frequency and time requirements over past years within the various NASA satellite tracking networks are described. A brief history of the network development is also given. S.F.

N81-27477*# Frequency Electronics, Inc., New Hyde Park, N.Y.

FREQUENCY AND TIME GENERATION AND CONTROL **c33**

Martin Bloch *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 211-251 (For primary document see N81-27467 18-36)

Avail: NTIS HC A99/MF A01 CSCL 09C

High precision quartz crystal oscillators, cesium beam atomic resonators, and cesium beam atomic standards for time and frequency generation equipment for ground, airborne, and space use are described. Because of the high risk factors involved, and the commercial applications of these products being too far off in the future, private capital for research and development is difficult if not impossible to obtain. More specific analysis and recommendations to overcome these difficulties are objectively presented. S.F.

N81-27478*# Frequency and Time Systems, Inc., Danvers, Mass.

GOVERNMENT AND INDUSTRY INTERACTIONS IN THE DEVELOPMENT OF CLOCK TECHNOLOGY **c31**

Helmut Hellwig *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 253-274 refs (For primary document see N81-27467 18-36)

Avail: NTIS HC A99/MF A01 CSCL 13H

It appears likely that everyone in the time and frequency community can agree on goals to be realized through the expenditure of resources. These goals are the same as found in most fields of technology: lower cost, better performance, increased reliability, small size and lower power. Related aspects are examined in the process of clock and frequency standard development. Government and industry are reviewed in a highly interactive role. These interactions include judgements on clock performance, what kind of clock, expenditure of resources, transfer of ideas or hardware concepts from government to industry, and control of production. Successful clock development and production requires a government/industry relationship which is characterized by long-term continuity, multidisciplinary team work, focused funding and a separation of reliability and production oriented tasks from performance improvement/research type efforts. S.F.

N81-27479*# KERNCO, Inc., Danvers, Mass.

INNOVATION AND RELIABILITY OF ATOMIC STANDARDS FOR PTTI APPLICATIONS **c35**

Robert Kern *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 275-280 (For primary document see N81-27467 18-36)

Avail: NTIS HC A99/MF A01 CSCL 20E

Innovation and reliability in hyperfine frequency standards and clock systems are discussed. Hyperfine standards are defined as those precision frequency sources and clocks which use a hyperfine atomic transition for frequency control and which have realized significant commercial production and acceptance (cesium, hydrogen, and rubidium atoms). References to other systems such as thallium and ammonia are excluded since these atomic standards have not been commercially exploited in this country. S.F.

N81-27480*# Hewlett-Packard Co., Santa Clara, Calif.

R AND D: TO FUND OR NOT TO FUND **c31**

Terry N. Osterdock *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 281-289 (For primary document see N81-27467 18-36)

Avail: NTIS HC A99/MF A01 CSCL 05A

U.S. Government spending to fund the research and development of electronics for a variety of applications is discussed. Commercial enterprises also spend large sums on research and development of electronics and other areas of interest to the U.S. Government and its agencies. The government can take advantage of industrial research programs and thereby maximize the utilization of their own. S.F.

N81-27481*# Rockwell International Corp., Anaheim, Calif. Defense Electronics Operations Div.

CONTRACTOR POINT OF VIEW FOR SYSTEM DEVELOPMENT AND TEST PROGRAM **c38**

Frank K. Koide, D. E. Ringer, and C. E. Earl *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 291-304 (For primary document see N81-27467 18-36)

Avail: NTIS HC A99/MF A01 CSCL 14D

Industry's practice of testing space qualified hardware is examined. An overview of the Global Positioning System (GPS) Test Program is discussed from the component level to the sub-system compatibility tests with the space vehicle and finally to the launch site tests, all related to the Rubidium clock. S.F.

N81-27482*# European Space Agency, Toulouse (France).

PROGRESS OF THE LASSO EXPERIMENT **c35**

Bernard E. H. Serene *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 307-327 (For primary document see N81-27467 18-36)

Avail: NTIS HC A99/MF A01 CSCL 14B

The LASSO (Later Synchronisation from Stationary Orbit) experiment, designed to demonstrate the feasibility of achieving time synchronization between remote atomic clocks with an

accuracy of one nanosecond or better by using laser techniques for the first time is described. The experiment uses ground-based laser stations and the SIRIO-2 geostationary satellite to be launched towards the end of 1981. The qualification of the LASSO on-board equipment is discussed with a brief description of the electrical and optical test equipment used. The progress of the operational organization is included. S.F.

N81-27483*# Istituto Elettrotecnico Nazionale (Galileo Ferraris), Turin (Italy).

TWO-WAY SEQUENTIAL TIME SYNCHRONIZATION: PRELIMINARY RESULTS FROM THE SIRIO-1 EXPERIMENT **c35**

E. Detoma and Sigfrido Leschiutta *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 329-350 refs Sponsored in part by the Italian National Research Council (For primary document see N81-27467 18-36)

Avail: NTIS HC A99/MF A01 CSCL 14B

A two-way time synchronization experiment performed in the spring of 1979 and 1980 via the Italian SIRIO-1 experimental telecommunications satellite is described. The experiment was designed and implemented to precisely monitor the satellite motion and to evaluate the possibility of performing a high precision, two-way time synchronization using a single communication channel, time-shared between the participating sites. Results show that the precision of the time synchronization is between 1 and 5 ns, while the evaluation and correction of the satellite motion effect was performed with an accuracy of a few nanoseconds or better over a time interval from 1 up to 20 seconds. S.F.

N81-27484*# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.

FLIGHT AND GROUND TESTS OF A GOES SATELLITE TIME RECEIVER FOR SATELLITE COMMUNICATIONS APPLICATIONS **c35**

Roger L. Swanson and Stephen A. Nichols (Naval Research Lab., Washington, D.C.) *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 351-376 refs (For primary document see N81-27467 18-36)

Avail: NTIS HC A99/MF A01 CSCL 14B

A satellite time receiver was tested in various environmental conditions during the past year. The commercial receiver designed to work with the National Oceanic and Atmospheric Administration's (NOAA) Geostationary Operational Environmental Satellites (GOES). The test program included operation at low elevation during flight in a military cargo aircraft and long term comparison with laboratory standards. The GOES satellite time receiver offers an opportunity to provide easy wide area coverage synchronization at low cost. S.F.

N81-27485*# Hydro-Quebec Inst. for Research, Varennes.

PTTI APPLICATIONS AT HYDRO-QUEBEC **c35**

Gills Missout, J. Beland, and G. Bedard *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 377-385 refs (For primary document see N81-27467 18-36)

Avail: NTIS HC A99/MF A01 CSCL 14B

As a power utility, Hydro-Quebec used the PTTI techniques. The time dissemination system in the Hydro-Quebec Network (11th PTTI) is now installed in several points. A portable clock was built using a rubidium standard and associated circuitry which are necessary for the measurements. The apparatus and the experimental results obtained are described. The use of GOES synchronized clocks for making precise voltage angle measurement on the Hydro-Quebec Network is discussed. Some modifications were made on a commercial unit. Applications and results are presented. E.D.K.

N81-27486*# Naval Observatory, Washington, D. C.

USNO GPS PROGRAM **c35**

Kenneth Putkovich *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 387-415 refs (For primary document see N81-27467 18-36)

Avail: NTIS HC A99/MF A01 CSCL 14B

Initial test results indicated that the Global Positioning System/Time Transfer Unit (GPS/TTU) performed well within the + or - 100 nanosecond range required by the original system specification. Subsequent testing involved the verification of GPS time at the master control site via portable clocks and the acquisition and tracking of as many passes of the space vehicles currently in operation as possible. A description and discussion of the testing, system modifications, test results obtained, and an evaluation of both GPS and the GPS/TTU are presented. E.D.K.

N81-27487*# AUSTRON, Inc., Austin, Tex.

DESIGN CONSIDERATIONS FOR A LORAN-C TIMING RECEIVER IN A HOSTILE SIGNAL TO NOISE ENVIRONMENT **c04**

James W. Porter, J. R. Bowell, and George E. Price *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 417-443 (For primary document see N81-27467 18-36)

Avail: NTIS HC A99/MF A01 CSCL 17G

The environment in which a LORAN-C Timing Receiver may function effectively depends to a large extent on the techniques utilized to insure that interfering signals within the pass band of the unit are neutralized. The baseline performance manually operated timing receivers is discussed and the basic design considerations and necessary parameters for an automatic unit utilizing today's technology are established. Actual performance data is presented comparing the results obtained from a present generation timing receiver against a new generation microprocessor controlled automatic acquisition receiver. The achievements possible in a wide range of signal to noise situations are demonstrated. E.D.K.

N81-27488*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SHORT TURN-AROUND INTERCONTINENTAL CLOCK SYNCHRONIZATION USING VERY-LONG-BASELINE INTERFEROMETRY Progress Report **c35**

George A. Madrid, Thomas P. Yunck, and R. B. Henderson *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 445-460 refs (For primary document see N81-27467 18-36)

(Contract NAS7-100)

Avail: NTIS HC A99/MF A01 CSCL 14B

During the past year work was accomplished to bring into regular operation a VLBI system for making intercontinental clock comparisons with a turn around of a few days from the time of data taking. Earlier VLBI systems required several weeks to produce results. The present system, which is not yet complete, incorporates a number of refinements not available in earlier systems, such as dual frequency inosopheric delay cancellation and wider synthesized bandwidths with instrumental phase calibration. E.D.K.

N81-27489*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RECENT PROGRESS IN THE NASA-GODDARD SPACE FLIGHT CENTER ATOMIC HYDROGEN STANDARDS PROGRAM **c35**

Victor S. Reinhardt *In its* Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 463-493 refs (For primary document see N81-27467 18-36)

Avail: NTIS HC A99/MF A01 CSCL 14B

At NASA Goddard Space Flight Center and through associated contractors, a broad spectrum of work is being carried out to develop improved hydrogen maser frequency standards for field use, improved experimental hydrogen maser frequency standards, and improved frequency and time distribution and measurement systems for hydrogen maser use. Recent progress in the following areas is reported: results on the Nr masers built by the Applied Physics Laboratory of Johns Hopkins University, the development of a low cost hydrogen maser at Goddard Space Flight Center, and work on a low noise phase comparison system and digitally phase locked crystal oscillator called the distribution and measurement system. E.D.K.

N81-27490*# Naval Research Lab., Washington, D. C.

PASSIVE MASER DEVELOPMENT AT NRL

Joseph D. White, A. Frank, and V. Folen *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 495-513 refs (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 20E

The application of passive hydrogen masers to satellites was investigated. The NRL maser is of compact design suitable for the space environment. It is based on a dielectrically loaded sapphire cavity and uses a computer optimized set of four shields. The servo design is a phase sensitive method which directly measures the phase dispersion of the interrogating signal as it passes through the cavity. E.D.K.

N81-27491*# Swiss Post Office, Berne.
REFERENCE CLOCK PARAMETERS FOR DIGITAL COMMUNICATIONS SYSTEMS APPLICATIONS c35
Peter Kartaschoff *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 515-549 refs (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 14B

The basic parameters relevant to the design of network timing systems describe the random and systematic time departures of the system elements, i.e., master (or reference) clocks, transmission links, and other clocks controlled over the links. The quantitative relations between these parameters were established and illustrated by means of numerical examples based on available measured data. The examples were limited to a simple PLL control system but the analysis can eventually be applied to more sophisticated systems at the cost of increased computational effort. E.D.K.

N81-27492*# Naval Surface Weapons Center, Dahlgren, Va.
AN ANALYTIC TECHNIQUE FOR STATISTICALLY MODELING RANDOM ATOMIC CLOCK ERRORS IN ESTIMATION c35
Patrick J. Fell *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 551-580 refs (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 14B

Minimum variance estimation requires that the statistics of random observation errors be modeled properly. If measurements are derived through the use of atomic frequency standards, then one source of error affecting the observable is random fluctuation in frequency. This is the case, for example, with range and integrated Doppler measurements from satellites of the Global Positioning and baseline determination for geodynamic applications. An analytic method is presented which approximates the statistics of this random process. The procedure starts with a model of the Allan variance for a particular oscillator and develops the statistics of range and integrated Doppler measurements. A series of five first order Markov processes is used to approximate the power spectral density obtained from the Allan variance. E.D.K.

N81-27493*# Naval Research Lab., Washington, D. C.
VACUUM PUMPING SYSTEM FOR SPACEBORNE PASSIVE HYDROGEN MASERS
Stuart A. Wolf, D. U. Gubser, and L. D. Jones *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 581-589 ref (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 20E

The ultimate utility of hydrogen masers as highly accurate clocks aboard navigation satellites depends on the feasibility of making the maser lightweight, compact, and capable of a 5 to 7 year unattended operation. A vacuum pumping system for the maser that is believed to meet these criteria was designed and fabricated. The pumping system was fabricated almost completely from 6Al-4V titanium alloy and incorporates two or four sintered zirconium carbon getter pumps with integral activation heaters. The manner in which the getter pumps were mounted to insure that they will stand both the activation and the shock of launch is illustrated. Data on the total hydrogen capacity and pumping of this system is also presented. E.D.K.

N81-27494*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FREQUENCY AND TIMING SYSTEM FOR THE CONSOLIDATED DSN AND STDN TRACKING NETWORK c32
Richard C. Coffin, Donald E. Johnson, and Paul F. Kuhnle *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 591-614 (For primary document see N81-27467 18-36) (Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 17B

The consolidation on the existing Deep Space Network (DSN) and colocated Goddard Spaceflight Tracking and Data Network (STDN) stations into a multiple antenna array is discussed. Each site includes a signal processing center (SPC) centered in an array of four or five antennas each located within approximately 300 to 800 meters of the SPC. A central frequency and timing system (FTS) located in the SPC contains reference frequency, timing and time code generation, and distribution equipment for both the SPC and each antenna with its associaed front end antenna control building. The reference frequency distribution and clock equipment are driven by a hydrogen maser as the prime frequency standard with cesium beam frequency standard as the secondary. E.D.K.

N81-27495*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Frequency and Time System Cognizant Operations Dept.
THE OPERATIONAL PERFORMANCE OF HYDROGEN MASERS IN THE DEEP SPACE NETWORK: THE PERFORMANCE OF LABORATORY REFERENCE FREQUENCY STANDARDS IN AN OPERATIONAL ENVIRONMENT
Samuel C. Ward *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 615-631 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 20E

Hydrogen masers used as aids in meeting the routine frequency and time operational requirements within the 64 m antenna Deep Space Network. Both the operational syntonation (frequency synchronization) and the the clock (epoch) synchronization requirements were established through the use of specifically calibrated H-P E215061A flying clock. The sync/synt to UTC was maintained using LORAN and TV in simultaneous reception mode. The sync/synt within the 64 m net was maintained through the use of very long base interferometry. Results indicate that the hydrogen masers perform well within the required specifications. R.C.T.

N81-27496*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SOURCE STRUCTURE ERRORS IN RADIO-INTERFEROMETRIC CLOCK SYNCHRONIZATION FOR TEN MEASURED DISTRIBUTIONS c32
J. B. Thomas *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 635-645 refs (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 20N

The effects of source structure on radio interferometry measurements were investigated. The brightness distribution measurements for ten extragalactic sources were analyzed. Significant results are reported. R.C.T.

N81-27497*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TIME AND FREQUENCY STABILITY FOR THE CRUSTAL DYNAMICS PROJECT
Robert J. Coates, J. Ryan, and T. Herring (MIT, Cambridge, Mass.) *In its* Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 649-662 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 20E

Very long base interferometry (VLBI) and laser ranging to artificial satellites and the Moon were used to determined vector baselines between stations with precisions of about one part in 10 to the 8th power. Deformations and strain acculations in active earthquake regions were determined by making frequent

measurements of baselines between many stations in active areas near plate boundaries. R.C.T.

N81-27498*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OPTICAL FIBERS FOR THE DISTRIBUTION OF FREQUENCY AND TIMING REFERENCES **c74**
George F. Lutes *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 663-680 refs (For primary document see N81-27467 18-36)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 20F

An optical fiber communications link was installed for the purpose of evaluating the applicability of optical fiber technology to the distribution of frequency and timing reference signals. It incorporated a 1.5km length of optical fiber cable containing two multimode optical fibers. The two fibers were welded together at one end of the cable to attain a path length of 3km. Preliminary measurements made on this link, including Allan variance and power spectral density of phase noise are reported. R.C.T.

N81-27499*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ON ESTIMATING THE EFFECTS OF CLOCK INSTABILITY WITH FLICKER NOISE CHARACTERISTICS **c35**
Sien-Chong Wu *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 681-701 refs (For primary document see N81-27467 18-36)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 14B

A scheme for flicker noise generation is given. The second approach is that of successive segmentation: A clock fluctuation is represented by 2N piecewise linear segments and then converted into a summation of N+1 triangular pulse train functions. The statistics of the clock instability are then formulated in terms of two sample variances at N+1 specified averaging times. The summation converges very rapidly that a value of N > 6 is seldom necessary. An application to radio interferometric geodesy shows excellent agreement between the two approaches. Limitations to and the relative merits of the two approaches are discussed. Author

N81-27500*# Air Force Systems Command, Norton AFB, Calif. Space Div.
NAVSTAR GLOBAL POSITIONING SYSTEM (GPS) CLOCK PROGRAM: PRESENT AND FUTURE **c04**
Douglas M. Tennant *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 703-710 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 17G

Global Positioning System (GPS) program status are discussed and plans for ensuring the long term continuation of the program are presented. Performance of GPS clocks is presented in terms of on orbit data as portrayed by GPS master control station kalman filter processing. The GPS Clock reliability program is reviewed in depth and future plans fo the overall clock program are published. R.C.T.

N81-27501*# Efratom Systems Corp., Irvine, Calif.
DEVELOPMENT OF A SUB-MINIATURE RUBIDIUM OSCILLATOR FOR SEEKTALK APPLICATION **c33**
Hugo Fruehauf, W. Weidemann, and E. Jechart *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 719-742 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 09C

Warm-up and size challenges to oscillator construction are presented as well as the problems involved in these tasks. The performance of M-100 military rubidium oscillator is compared to that of a subminiture rubididum oscillator (M-1000). Methods of achieving 1.5 minute warm-up are discussed as well as improvements in performance under adverse environmental conditions, including temperature, vibration, and magnetics. An attempt is made to construct an oscillator error budget under a set of arbitrary mission conditions. R.C.T.

N81-27502*# Frequency Electronics, Inc., New Hyde Park, N.Y.
THE NATO 3% MHz DISTRIBUTION SYSTEM **c32**
A. Vulcan and M. Bloch *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 743-764 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 17B

A high performance 5 MHz distribution system is described which has extremely low phase noise and jitter characteristics and provides multiple buffered outputs. The system is completely redundant with automatic switchover and is self-testing. Since the 5 MHz reference signals distributed by the NATO III distribution system are used for up-conversion and multiplicative functions, a high degree of phase stability and isolation between outputs is necessary. Unique circuit design and packaging concepts insure that the isolation between outputs is sufficient to quarantee a phase perturbation of less than 0.0016 deg when other outputs are open circuited, short circuited or terminated in 50 ohms. Circuit design techniques include high isolation cascode amplifiers. Negative feedback stabilizes system gain and minimizes circuit phase noise contributions. Balanced lines, in lieu of single ended coaxial transmission media, minimize pickup. A.R.H.

N81-27503*# Frequency Electronics, Inc., New Hyde Park, N.Y.
THE SA-2239/WLQ-4(V) CUTTY SARK DISTRIBUTION SYSTEM **c32**
Alfred Vulcan and John Ho *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval. and Planning Mar. 1981 p 765-783 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 09C

A redundant frequency and time distribution system provides a multiplicity of isolated outputs, all of which are derived from three atomic frequency standards. The distribution system monitors input parameters of the signals coming from the Cesium Standards and selects one to be the primary standard, phase locks an internal oscillator which has excellent aging characteristics in the open loop mode and acts as a filter to provide phase noise improvement, and generates 1 megahertz and 100 kHz by direct synthesis. Additionally, the system distributes RF and timing signals consisting of 5 MHz, 1 MHz, 100 kHz, BCD Time-of-Day, 1 pps and 1 ppm. A.R.H.

N81-27504*# National Bureau of Standards, Boulder, Colo. Frequency and Time Standards Group.
PRECISION TIMEKEEPING USING A SMALL PASSIVE HYDROGEN MASER
F. L. Walls and David A. Howe *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 785-804 refs (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 20E

The timekeeping ability of a prototype passive hydrogen maser which is a factor of 5 smaller in size, weight, and cost than any previously designed, was compared to UTC (NBS) based on 10 cesium frequency standards including a large primary standard, NBS-4. The frequency of the prototype was monitored as a function of source pressure, cavity temperature, microwave power, modulation width, and magnetic field. Based on these measurements, a frequency stability of better than 6 x 10 to the -15 power was expected, implying a timekeeping ability of order 0.5 ns/day. Measurements vs UTC(NBS) indicate a joint timekeeping a stability of order 1.2 ns/day. Simultaneous measurements made between NBS-4, UTC(6600), and the small passive me maser show peak to peak time variations of the small maser vs UTC(6600) was 10 ns for the full 32 days if the average rate and drift are considered. Frequency stability of the small prototype vs UTC (NBS) was to 1.1 x 10 to the -14th power for tau = 1 to 8 days. A.R.H.

N81-27505*# Laval Univ. (Quebec). Lab. Electronique Quantique.
HYDROGEN MASER DEVELOPMENT AT LAVAL UNIVERSITY Progress Report
Jacques Vanier, Guy Racine, Ryszard Kunski, and Marcel Picard *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 807-828 refs (For primary document see

N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 20E

The physical construction of two hydrogen masers is described and results of measurements made on one of the masers are given. These include: cavity Q, thermal time contsant, line Q, signal power output, magnetic shielding factor. Preliminary results indicate that the frequency stability will be mainly affected by the thermal of the cavity. The magnetic field and the barometric fluctuations should not affect the maser at the stability level above a few parts in 10 to the 15th power, which is the goal for averaging times of several hours. A.R.H.

N81-27506*# National Physical Lab., New Delhi (India).
SOME NEW RESULTS ON THE FREQUENCY CHARACTERISTICS ON QUARTZ CRYSTALS IRRADIATED BY IONIZING AND PARTICLE RADIATIONS c32
Harish Bahadur and R. Parshad *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 829-849 refs (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 20N

The frequency behavior of AT-cut quartz crystals irradiated by X -, gamma rays and fast neutrons. Initial instability in frequency for gamma and neutron irradiated crystals was found. All the different radiations first give a negative frequency shift at lower doses which are followed by positive frequency shift for increased doses. Results are explained in terms of the fundamental crystal structure. Applications of the frequency results for radiation hardening are proposed. A.R.H.

N81-27507*# National Physical Lab., New Delhi (India). Time and Frequency Section.
PRECISE T AND F INTERCOMPARISON VIA VLF PHASE MEASUREMENTS c35
A. Sen Gupta, G. K. Goel, and B. S. Mathur *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 851-862 refs (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 14B

Continuous phase recording of the 16kHz transmission from GBR (UK) are being made and published midday phase data of GBR are received regularly from laboratories in the US, FGR, and UK. The local time scale (UTC, India), at the National Physical Laboratory in New Delhi, and those at the foreign laboratories are intercompared using the VLF phase data. A major factor which limits the accuracy of long term comparison is the seasonal variation in the VLF over delay over long paths. By taking into account the seasonal delay variations in a semiempirical way, the accuracy of time and frequency comparisons can be improved. Over a one year period, accuracy of a few parts in 10 to the 14th power in frequency and 1 to 2 micron sec in time were obtained. The relative frequency offset difference between UTC, (India) and UTC (PTB, Germany) of (7.0 + or - 0.1) x 10 to the -13 power agrees well with that obtained in a satellite experiment. A.R.H.

N81-27508*# National Physical Lab., New Delhi (India). Time and Frequency Section.
PRECISE TIME AND FREQUENCY INTERCOMPARISON BETWEEN NPL, INDIA AND PTB, FEDERAL REPUBLIC OF GERMANY VIA SATELLITE SYMPHONIE-1 c35
B. S. Mathur, P. Banerjee, P. C. Sood, Mithlesh Saxena, Nand Kumar, and A. K. Suri *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 863-874 refs (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 14B

A time and frequency intercomparison experiment conducted using Earth stations in New Delhi, India and Raisting, FRG is described. The NPL clock was placed at New Delhi Earth Station and the Raisting Clock was calibrated with PTB/Primary standard via LORAN-C and travelling clocks. The random uncertainity of time comparisons, represented by two sample Allan Variance sigma (30 seconds), was less than 10 nanoseconds. The relative frequency difference between the NPL and Raisting Clocks, SNPL, RAIS, as measured over the 44 days period was found to be -15.7 x 10 to the -13th power. The relative frequency difference between PTB Primary Standard and Raisting Clock, SPTB, RAIS, during this period, was measured to be -22.8 x 10 to the -13th power. The relative frequency difference between NPL clock and PTB Primary Standard, SNPL, PTB, thus, is +7.1 x 10 to the -13th power. The clock rate (UTC, India) of +7.1 + or - 0.5 x 10 to the -13th power, agrees well with that obtained via VLF phase measurements over one year period and with USNO travelling clock time comparisons made in September, 1980. A.R.H.

N81-27509*# Boeing Aerospace Co., Seattle, Wash.
LASER ANGLE SENSOR DEVELOPMENT
C. R. Pond and P. D. Texeira Oct. 1980 73 p
(Contract NAS1-15987)
(NASA-CR-159385) Avail: NTIS HC A04/MF A01 CSCL 20E

Electrical and optical parameters were developed for a two axis (pitch/roll) laser angle sensor. The laser source and detector were mounted in the plenum above the model. Two axis optical distortion measurements of flow characteristics in a 0.3 miransonic cryogenic tunnel were made with a shearing interferometer. The measurement results provide a basis for estimating the optical parameters of the laser angle sensor. Experimental and analytical information was generated on model windows to cover the reflector. A two axis breadboard was assembled to evaluate different measurement concepts. The measurement results were used to develop a preliminary design of a laser angle sensor. Schematics and expected performance specifications are included. R.C.T.

N81-27510# Hughes Research Labs., Malibu, Calif.
CORRECTION OF PHASE DISTORTIONS BY NONLINEAR OPTICAL TECHNIQUES Status Report, 16 Jul. - 15 Oct. 1980
R. C. Lind 15 Oct. 1980 37 p
(Contract N00014-77-C-0593; DARPA Order 3427)
(AD-A098924) Avail: NTIS HC A03/MF A01 CSCL 20/5

The effort in this program is divided into three tasks. The first task is an experimental effort to explore the physics of phase conjugation via four-wave mixing in the visible with emphasis on the blue-green and ultraviolet region of the spectrum using appropriate dye lasers. Issues such as degree of correction, efficiency, and required pump wave properties will be addressed in this task. In addition, we will determine the efficiency of conjugate wave generation as a function of detuning of the pump frequency from the probe frequency a concept which has direct impact on systems concepts. The second task concentrates on expanding our understanding of the theory of four-wave mixing with emphasis on the pump manipulation and polarization rotation issues and on those features that maximize the efficiency of the process, such as resonant enhancement. In addition, on this task we will select material candidates that show promise for high-power application in the blue-green and UV. The third task will concentrate on the systems-related issues of nonlinear phase conjugation with emphasis on systems of interest to DARPA. We will expand our analysis of the concepts generated and generate new concepts. We will also identify critical technologies for high-power application of nonlinear phase conjugation to DARPA systems. GRA

N81-27511# Lincoln Lab., Mass. Inst. of Tech., Lexington.
REMOTE SENSING OF TURBINE ENGINE GASES Final Report, 1 Oct. 1979 - 30 Sep. 1980
Dennis K. Killinger, Norman Menyuk, and Aram Mooradian 30 Sep. 1980 50 p refs
(Contract F19628-80-C-0002; AF Proj. 2900)
(AD-A099638; ESD-TR-81-41; AFESC/ESL-TR-81-16) Avail: NTIS HC A03/MF A01 CSCL 20/5

This is the FY 80 final report for a laser remote sensing program designed to investigate remote sensing techniques for the detection of jet aircraft exhaust gases. The specific tasks which were performed consisted of the following: (1) continuation of feasibility demonstration of CO2 TEA laser remote sensing system and the detection of NO and C2H4 in the atmosphere; (2) continuation of laboratory absorption measurements of CO, NO, and C2H4; (3) initial laboratory investigation of suitability of laser remote s U;e, Unsing of hydrazine, UDMH, and MMH; (4) implemenation of digital data acquisition and processing

system; and (5) preliminary development of dual-laser DIAL system. Author (GRA)

N81-27512# Naval Research Lab., Washington, D. C. Plasma Laser Branch.

DARK-FIELD STUDY OF REAR-SIDE DENSITY STRUCTURE IN LASER-ACCELERATED FOILS

J. A. Stamper, S. H. Gold, S. P. Obenschain, E. A. McLean, and L. Sica 8 Jun. 1981 19 p refs Submitted for publication Sponsored in part by DOE

(AD-A099809; NRL-MR-4530) Avail: NTIS HC A02/MF A01 CSCL 18/1

A dark-field, laser-probing diagnostic has produced the first high-resolution photographs of density structure on the rear side of laser-accelerated foils. This diagnostic allows the preferential sampling of the steep-gradient region of an expanding plasma and permits two-dimensional, multiple-time recordings on a single photograph. The studies are aimed at understanding the early-time physics of target implosions for inertial-confinement fusion. Both long (500 psec) and short (150 psec) probe pulses were used to study the rear-side plasmas of thin foils accelerated by the rocket-like reaction to a hot plasma ablated from the front side by the laser radiation. The longer pulse results, both for angular scatter and the life-time of small, transverse structure, imply a relatively cold (1 eV) rear side plasma. The short pulses provide high resolution photographs of the complete structure. One of these was a vortex-like structure, suggestive of the remnants of a hydrodynamic instability. These observations are relevant to two of the basic requirements of inertial-confinement fusion: cold fuel isentrope and implosion symmetry. Author (GRA)

N81-27513# Florida Univ., Gainesville. Dept. of Nuclear Engineering Sciences.

GAIN AND LASING IN NUCLEAR EXCITED EXCIMER LASER SYSTEMS Final Report, 29 Jun. 1979 - 28 Feb. 1981

Roy A. Walters, John D. Cox, and Richard T. Schneider 24 Apr. 1981 81 p refs

(Contract DASG60-79-C-0083)

(AD-A099753) Avail: NTIS HC A05/MF A01 CSCL 20/5

A He:Xe nuclear pumped flashlamp laser system based on a burst reactor neutron source has been constructed. The optical output of the flashlamp exceeds 500 joules from 170 nm xe2 fluorescence and 200 joules from Xe and the Xe continuum in the visible. The XeF2 photolysis XeF (C-A) laser system (483 nm) studied did not lase as expected. Gain (2 % meter) was observed at a lower level than expected. An alternate laser output at 370 nm from S is suspected. The concept of 'parasitic amplification' was developed to explain the discrepancy between calculated gain and lasing and the observed results. Alternate nuclear flashlamp laser concepts and direct nuclear pumped laser systems are reviewed. GRA

N81-27514# Smithsonian Astrophysical Observatory, Cambridge, Mass.

A STUDY OF CRYOGENIC TECHNIQUES FOR OPERATING HYDROGEN MASERS Interim Report, 1 Feb. 1980 - 30 Apr. 1981

Robert F. C. Vessot May 1981 5 p refs

(Contract N00014-77-C-0777)

(AD-A099528) Avail: NTIS HC A02/MF A01 CSCL 20/5

Cryogenic Techniques are applied to the Atomic Hydrogen Maser Frequency Standard to extend the storage time of the atoms and reduce the thermal noise accompanying the signal and within the resonance linewidth. Oscillation has been achieved below 25K using wall coatings of frozen CF4. This method will be used to determine the wall interaction for Atomic Hydrogen on a variety of other surfaces. A pair of new masers is under construction so that frequency stability improvement can be measured. Stability at the 1 x 10 to the minus 16th power level in delta f/f for averaging time intervals of 1,000 seconds is expected at temperatures below 30K. Author (GRA)

N81-27515# Sandia Labs., Albuquerque, N. Mex.

LASER RAYLEIGH THERMOMETRY IN TURBULENT FLAMES

R. W. Dibble and R. E. Hollenbach Jan. 1981 27 p refs Presented at 18th Combust. Symp., Waterloo, Canada, 17 Aug. 1980

(Contract DE-AC04-76DP-00789)

(SAND-80-8623; CONF-800809-7) Avail: NTIS HC A03/MF A01

Nonintrusive, spatially and temporally resolved temperature measurements in turbulent flames, premixed and nonpremixed, using laser Rayleigh scattering are reported. Laser Rayleigh scattering can be used to measure temperature (or concentration) at a data rate, and hence frequency response, DC-15 kHz, that is undemonstrated by any other present day laser based technique. Two demonstrations of laser Rayleigh thermometry are described: a turbulent premixed flame; and a turbulent jet diffusion flame. In these demonstrations, the Rayleigh scattered light intensity from a CW laser is used to produce a time series of temperature. From that time series, the temperature probabilty distribution function is generated as well as the power spectrum and autocorrelation. From the probabilty distribution function, the mean, variance and higher moments are easily generated. DOE

N81-27516# California Univ., Livermore. Lawrence Livermore Lab. Dept. of Electrical Engineering and Computer Science.

PHYSICS OF SHORT-WAVELENGTH-LASER DESIGN Ph.D. Thesis

Peter Laurence Hagelstein Jan. 1981 452 p refs

(UCRL-53100) Avail: NTIS HC A20/MF A01

The physics and design of VUV and soft X-ray lasers pumped by ICF class high intensity infrared laser drivers are described. Laser design and physics issues are discussed in the case of a photoionization pumping scheme involving Ne II and line pumping schemes involving H-like and He-like neon. DOE

N81-27517# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

A DIGITAL LASER DOPPLER PROCESSOR

R. S. Figliola Jul. 1980 27 p ref

(VKI-TM-30) Avail: NTIS HC A03/MF A01

A method which digitalizes the output of the photomultiplier of a laser Doppler velocimetry system and then processes the signal using data reduction software is described. Programs can be adapted to special measurement tasks while eliminating to a large extent the number of specialized hardware processors required. The processor operates in the N-cycle mode, N being chosen to minimize bias. A zero crossing routine is used for data processing. The system was only tested at very low frequencies (10 kHz). Author (ESA)

N81-27518# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

KALMAN FILTER ORBIT IMPROVEMENT FROM KOOTWIJK LASER RANGE OBSERVATIONS

K. F. Wakker, B. A. C. Ambrosius, and J. J. P. vanHulzen Sep. 1980 40 p refs Presented at 23rd COSPAR Meeting, Budapest, Jun. 1980 Revised

(VTH-LR-301) Avail: NTIS HC A03/MF A01

The possibility of using laser range observations acquired at one ground station for real time position prediction updates during each pass and better predictions for subsequent passes was investigated. A computer program, SORKA, was written, based on a sequential extended Kalman filter scheme. The methods to compute the state transition matrix and the state noise covariance matrix were emphasized. The dependence of the Kalman gain matrix on the reference state is shown and the techniques used in SORKA to improve the stability of the filter and to detect divergence discussed. Results using laser data acquired during eight passes of GEOS-1 over the Kootwijk ground station are presented. Author (ESA)

N81-27132*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

HIGH POWER SEMICONDUCTOR LASERS FOR DEEP SPACE COMMUNICATIONS

J. Katz *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 40-50 refs (For primary document see N81-27123 18-12)

Avail: NTIS HC A11/MF A01 CSCL 20E

N81-27147*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

THE OPERATIONAL PERFORMANCE OF HYDROGEN MASERS IN THE DEEP SPACE NETWORK (THE PERFORMANCE OF LABORATORY REFERENCE FREQUENCY STANDARDS IN AN OPERATIONAL ENVIRONMENT)
S. C. Ward *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 203-218 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 20E

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N81-27519* National Aeronautics and Space Administration. Pasadena Office, Calif.
TERMINAL GUIDANCE SENSOR SYSTEM
Antal K. Bejczy, inventor (to NASA) (JPL, California Inst. of Technology, Pasadena) 7 Apr. 1981 9 p Filed 23 Mar. 1979 Sponsored by NASA
(NASA-Case-NPO-14521-1; US-Patent-4,260,187; US-Patent-Appl-SN-023439; US-Patent-Class-294-86R; US-Patent-Class-244-161; US-Patent-Class-318-640; US-Patent-Class-356-152; US-Patent-Class-414-730) Avail: US Patent and Trademark Office CSCL 13I

A system is described for guiding a claw to the proper distance and into the proper orientation in yaw and pitch, to engage a grappling fixture. The system includes four proximity sensors on the claw, that are arranged at corners of an imaginary square, which sense the distance to the top surface of the grappling fixture. If a pair of sensors at opposite corners of the square sense a different distance to the top surface of the grappling fixture, then it is known that the claw is rotated about a corresponding axis with respect to the plane of the grappling fixture.
Official Gazette of the U.S. Patent and Trademark Office

N81-27520 British Library Lending Div., Boston Spa (England).
METHOD OF CHARACTERISTIC PERFORMANCE CALCULATION OF JOURNAL BEARINGS UNDER DYNAMIC LOADING
Eiichi Nakagawa Feb. 1981 19 p refs Transl. into ENGLISH from Ishikawajima-Harima (Eng. Rev.) (Giho), 1974 19 p
(BLL-RTS-12354) Avail: British Library Lending Div., Boston Spa, England

A procedure for computing journal locus is suggested, building on a previously published theoretical analysis. The following aspects are involved: (1) determination of minimum oil film thickness; (2) location of the oil input hole and oil drain; (3) keeping the maximum load on metallic bearings within permissible limits; and (4) the onset of cavitation. Examples of calculation are provided, together with recommendations on the future planning of bearings. S.F.

N81-27521*# Detroit Diesel Allison, Indianapolis, Ind.
ABRADABLE DUAL-DENSITY CERAMIC TURBINE SEAL SYSTEM Final Report
D. L. Clingman, B. Schechter, K. R. Cross, and J. R. Cavanagh Feb. 1981 144 p
(Contract NAS3-22012)
(NASA-CR-165309; EDR-10600) Avail: NTIS HC A07/MF A01 CSCL 11A

A plasma sprayed dual density ceramic abradable seal system for direct application to the HPT seal shroud of small gas turbine engines. The system concept is based on the thermal barrier coating and depends upon an additional layer of modified density ceramic material adjacent to the gas flow path to provide the desired abradability. This is achieved by codeposition of inert fillers with yttria stabilized zirconia (YSZ) to interrupt the continuity of the zirconia struture. The investigation of a variety of candidate fillers, with hardness values as low as 2 on Moh's scale, led to the conclusion that solid filler materials in combination with a YSZ matrix, regardlss of their hardness values, have a propensity for compacting rather than shearing as originally expected. The observed compaction is accompanied by high energy dissipation in the rub interaction, usually resulting in the adhesive transfer of blade material to the stationary seal member. Two YSZ based coating systems which incorported hollow alumino silicate spheres as density reducing agents were surveyed over the entire range of compositions from 100 percent filler to 100 percent YSZ. Abradability and erosion characteristics were determined, hardness and permeability characterized, and engine experience acquired with several system configurations. S.F.

N81-27522*# Akron Univ., Ohio. Dept. of Civil Engineering.
FINITE ELEMENT FOR ROTOR/STATOR INTERACTIVE FORCES IN GENERAL ENGINE DYNAMIC SIMULATION. PART 1: DEVELOPMENT OF BEARING DAMPER ELEMENT Technical Report, 1 Aug. 1979 - 31 Jul. 1979
M. L. Adams, J. Padovan, and D. G. Fertis Oct. 1980 77 p refs
(Grant NsG-3283)
(NASA-CR-165214; EDA-201-3A) Avail: NTIS HC A05/MF A01 CSCL 13I

A general purpose squeeze-film damper interactive force element was developed, coded into a software package (module) and debugged. This software package was applied to nonliner dynamic analyses of some simple rotor systems. Results for pressure distributions show that the long bearing (end sealed) is a stronger bearing as compared to the short bearing as expected. Results of the nonlinear dynamic analysis, using a four degree of freedom simulation model, showed that the orbit of the rotating shaft increases nonlinearity to fill the bearing clearance as the unbalanced weight increases. Author

N81-27523*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SURFACE FILMS AND METALLURGY RELATED TO LUBRICATION AND WEAR Ph.D. Thesis - Tokyo Inst. of Technology
Donald H. Buckley Jul. 1981 218 p refs
(NASA-TM-82645; E-900) Avail: NTIS HC A08/MF A01 CSCL 11H

The nature of the tribological surface is identified and characterized with respect to adhesion, friction, wear, and lubricating properties. Surface analysis is used to identify the role of environmental constituents on tribological behavior. The effect of solid to solid interactions for metals in contact with metals, ceramics, semiconductors, carbons, and polymers is discussed. The data presented indicate that the tribological surface is markedly different than an ideal solid surface. The environment is shown to affect strongly the behavior of two solids in contact. Results also show that small amounts of alloying elements in base metals can alter markedly adhesion, friction, and wear by segregating to the solid surface. A.R.H.

N81-27524*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTIMAL TOOTH NUMBERS FOR COMPACT STANDARD SPUR GEAR SETS
Michael Savage (Akron Univ.), John J. Coy, and Dennis P. Townsend 1981 33 p refs Proposed for presentation at the Design Eng. Tech. Meeting, Hartford, Conn., 20-23 Sep. 1981; Sponsored by ASME and presented at the NASA-AVRADCOM Symp. on Advan. Power Transmission Technol., Cleveland, 9-11 Jun. 1981 Prepared in cooperation with Army Aviation Research and Development Command, Cleveland
(Grant NAG3-55)
(NASA-TM-82614; E-865; AVRADCOM-TR-81-C-15) Avail: NTIS HC A03/MF A01 CSCL 13I

The design of a standard gear mesh is treated with the objective of minimizing the gear size for a given ratio, pinion torque, and allowable tooth strength. Scoring, pitting fatigue, bending fatigue, and the kinematic limits of contact ratio and interference are considered. A design space is defined in terms of the number of teeth on the pinion and the diametral pitch. This space is then combined with the objective function of minimum center distance to obtain an optimal design region. This region defines the number of pinion teeth for the most compact design. The number is a function of the gear ratio only. A design example illustrating this procedure is also given.
Author

N81-27525*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A METHOD OF SELECTING GRID SIZE TO ACCOUNT FOR HERTZ DEFORMATION IN FINITE ELEMENT ANALYSIS OF SPUR GEARS

John J. Coy and Charles Hu-Chih Chao (Northwestern Univ.) 1981 27 p refs Proposed for presentation at the Design Eng. Tech. Conf., Hartford, Conn., 20-23 Sep. 1981; sponsored by ASME Prepared in cooperation with Army Aviation Research and Development Command, Cleveland

(NASA-TM-82623; E-728; AVRADCOM-TR-81-C-14) Avail: NTIS HC A03/MF A01 CSCL 13I

A method of selecting grid size for the finite element analysis of gear tooth deflection is presented. The method is based on a finite element study of two cylinders in line contact, where the criterion for establishing element size was that there be agreement with the classical Hertzian solution for deflection. The results are applied to calculate deflection for the gear specimen used in the NASA spur gear test rig. Comparisons are made between the present results and the results of two other methods of calculation. The results have application in design of gear tooth profile modifications to reduce noise and dynamic loads.

S.F.

N81-27526*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SURFACE ROUGHNESS EFFECT ON FINITE OIL JOURNAL BEARINGS

B. C. Majumdar and B. J. Hamrock 1981 27 p refs Proposed for presentation at the Intern. Conf. on Optimum Resources Utilization through Tribo-Terrotechnol. and Maintenance Management at the Indian Inst. of Technol., New Delhi, 30 Nov. - 6 Dec. 1981

(NASA-TM-82639; E-894) Avail: NTIS HC A03/MF A01 CSCL 13I

A theoretical study of the performance of finite oil journal bearings is made, considering the surface roughness effect. The total load supporting ability under such a condition derives from the hydrodynamic as well as asperity contact pressure. These two components of load are calculated separately. The average Reynolds equation for partially lubricated surfaces is used to evaluate hydrodynamic pressure. An analytical expression for average film thickness is obtained and introduced to modify the average Reynolds equation. The resulting differential equation is then solved numerically by finite difference methods for mean hydrodynamic pressure, which in turn gives the hydrodynamic load. Assuming the surface height distribution as Gaussian, the asperity contact pressure is found. The effect of surface roughness parameter, surface pattern, eccentricity ratio, and length to diameter ratio on hydrodynamic load and on side leakage is investigated. It is shown that hydrodynamic load increases with increasing surface roughness when both journal and bearing surfaces have identical roughness structures or when the journal only has a rough surface. The trend of hydrodynamic load is reversed if the journal surface is smooth and the bearing surface is rough.

Author

N81-27527# Sandia Labs., Albuquerque, N. Mex.

VERTICAL AXIS WIND TURBINE DRIVE TRAIN TRANSIENT DYNAMICS

D. B. Clauss and T. G. Carne 1981 17 p refs presented at DOE/NASA Wind Turbine Dyn. Workshop, Cleveland, 24 Feb. 1981

(Contract DE-AC04-76DP-00789)

(SAND-80-2646C; CONF-810226-1) Avail: NTIS HC A02/MF A01

Transient torque oscillations in the drive train caused by start up of a vertical axis wind turbine were studied using a computer code based on a lumped parameter model of the drive train program was developed and tested for the low cost 17 meter turbine. Responses for several different transient operations were predicted and possible design modifications intended to reduce transient torque levels were developed. The program is shown to be a drive train design tool to ensure safe and reliable operation of the turbine.

DOE

N81-27528# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.

ADVANCED INDUSTRIAL GAS TURBINE TECHNOLOGY READINESS DEMONSTRATION PROGRAM. PHASE 2: COMPRESSOR RIG FABRICATION ASSEMBLY AND TEST Final Report

J. K. Schweitzer and J. D. Smith Mar. 1981 121 p refs

(Contract DE-AC05-76OR-05035)

(DOE/OR-05035/T2) Avail: NTIS HC A06/MF A01

The results of a component technology demonstration program to fabricate, assemble and test an advanced axial/centrifugal compressor are presented. This work was conducted to demonstrate the utilization of advanced aircraft gas turbine cooling and high pressure compressor technology to improve the performance and reliability of future industrial gas turbines. Specific objectives of the compressor component testing were to demonstrate 18:1 pressure ratio on a single spool at 90 percent polytropic efficiency with 80 percent fewer airfoils as compared to current industrial gas turbine compressors. The compressor design configuration utilizes low aspect ratio/highly loaded axial compressor blading combined with a centrifugal backened stage to achieve the 18:1 design pressure ratio in only 7 stages and 281 axial compressor airfoils. Initial testing of the compressor test rig was conducted with a vaneless centrifugal stage diffuser to allow documentation of the axial compressor performance.

DOE

N81-27529# Argonne National Lab., Ill. Energy and Environmental Systems Div.

EVALUATION OF ADVANCED TURBOMACHINERY FOR UNDERGROUND PUMPED HYDROELECTRIC STORAGE. PART 3: MULTISTAGE UNREGULATED PUMP/TURBINES FOR OPERATING HEADS OF 1000 TO 1500 m

A. A. Frigo and C. Pistner (Allis-Chalmers Corp.) Aug. 1980 131 p refs

(Contract W-31-109-eng-38)

(ANL/ES-102-Pt-3) Avail: NTIS HC A07/MF A01

Multistage unregulated pump/turbines for underground pumped hydroelectric storage are considered. Multistage unregulated pump/turbines offer an economically attractive option for heads of 1000 to 1500 m. The feasibility of developing such machines for capacities up to 500 MW and operating heads up to 1500 m has been evaluated. Preliminary designs have been generated for six multistage pump/turbines. The designs are for nominal capacities of 350 and 500 MW and for operating heads of 1000, 1250, and 1500 m. Mechanical, hydraulic, and economic analyses indicate that these machines will behave according to the criteria used to design them and that they can be built at a reasonable cost with no unsolvable problems. Efficiencies of 85.8 percent and 88.5 percent in the 1500 m unit. Performances of the other five machines are at least comparable, and usually better. Over a 1000 to 1500 m head range, specific $/kW costs of the pump/turbines in mid 1978 US dollars vary from 19.0 to 23.1 for the 500 MW machines, and from 1.0 to 24.1 for the 350 MW machines.

DOE

N81-27530# Biphase Energy Systems, Inc., Santa Monica, Calif.

STUDY OF TWO-PHASE TURBINE ENGINE FOR SOLAR SPACE COOLING Final Report

William E. Amend Aug. 1980 83 p

(Contract EG-77-C-03-1542)

(DOE/CS-31542/T1) Avail: NTIS HC A05/MF A01

Detailed mathematical description of two promising refrigeration cycles were developed and programmed on the computer (all known first-order irreversibilities were accounted for). Extensive parameter sweeps were made to identify the most effective working-fluid combinations and to determine the sensitivity of cycle-performance levels. A Cycle configuration was established for a nominal 3 ton air cooled refrigeration system and the design parameters were determined from the computer code. A series of fluid compatibility tests were run to weed out potential fluid combinations that are reactive.

DOE

N81-27531# Franklin Research Center, Philadelphia, Pa. Coal Combustion Systems Div.

FAILURE-CAUSE ANALYSIS: TURBINE BEARING SYSTEMS. PHASE 1: DEVELOPMENT OF DATA COLLECTION PLAN

H. C. Rippel Apr. 1981 27 p Sponsored by Electric Power

Research Inst.
(EPRI Proj. 1265-3)
(EPRI-CS-1801-SY) Avail: NTIS HC A03/MF A01

Objectives of Phase 1 were to: (1) identify and tentatively rank the proximate/root causes of genetic problems that result in failures of the rotor/bearing/lube systems; (2) determine the nature of the available data and select the appropriate methodologies for both data collection and analysis; and (3) develop the data collection plan to be implemented during Phase 2. These objectives were accomplished by: surveying existing data bases, relevant literature and technical personnel; implementing an integrated analysis approach to maximize the value of the information available; and finally, structuring a data collection plan based on a mail survey of all utilities having unit capacities greater than 300 MW, on site visits to selected utilities, and personal interviews with industry experts. The successful completion of Phase 1 has established the foundation for the subsequent phases of this study. DOE

N81-27532# Kirkwood (A. C.) and Associates, Kansas City, Mo.
MARKET POTENTIAL FOR SMALL ADVANCED THERMO-MECHANICAL CYCLE COMBUSTION TURBINE GENERATORS Final Report
B. J. Kirkwood Apr. 1981 96 p
(EPRI-AP-1778; TPS-79-770) Avail: NTIS HC A05/MF A01

Three prototype concepts were evaluated. Concept A is a 2.5 MWe externally fired, closed cycle combustion turbine, with fluidized bed combustor, burning solid fuels. Concept B is an open 3.8 MWe, indirect fired, combined cycle turbine C is 11.6 MWe, utilizing an open, direct fired, combined cycle turbine arrangement, gas or oil fueled employing components of advanced development. It was presumed such units might be commercially available circa 1985 to 1990. Fifty-three utilities, encompassing a variety of ownerships, geographical distribution and system sizes, were interviewed on site. Questions covered the probable use of such generating concepts and their perceived attributes. The report presents the pattern of these responses and concludes that viable interest centers primarily on a coal fired, fluidized bed unit of the size of C or B, offering high efficiency and reliable operation. Such a unit would be utilized in baseload and intermediate duty operation. Absent coal capability, there would be little potential to compete with existing, proven, moderate cost, highly efficient internal combustion engines. DOE

N81-27533# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
TESTING OF BELLOWS FOR ENGINEERING SYSTEMS, PART 2
H. E. McCoy, Jr. and B. McNabb Apr. 1981 43 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7650-Pt-2) Avail: NTIS HC A03/MF A01

Techniques were developed for performing elastic, creep, fatigue, and squirm tests on several specific geometries of Hastelloy X and type 347 stainless steel bellows. The fatigue cycle studies was complex and included time, temperature strain, and internal pressure as variables. A programmable calculator was used to control the test and record data. Fatigue failures occurred by typical high temperature deformation modes, and observed lifetimes were close to those predicted by the designer. In creep tests where bellows length was restrained, individual convolutions widened while the gaps between convolutions contracted. Deformation during creep was often very inhomogeneous. Nevertheless, this test program showed that bellows can be designed and characterized for engineering service. DOE

N81-27534# United Technologies Research Center, East Hartford, Conn.
TURBINE COOLING CONFIGURATION SELECTION AND DESIGN OPTIMIZATION FOR THE HIGH-RELIABILITY GAS TURBINE Final Report, Apr. 1981
Mikio Suo Apr. 1981 52 p refs
(Contract DE-AC05-79ET-15331)
(DOE/ET-15331/T1; GTR-2380) Avail: NTIS HC A04/MF A01

The potential of advanced turbine convectively air-cooled concepts for application to the Department of Energy/Electric Power Research Institute (EPRI) Advanced Liquid/Gas Fueled Engine Program was investigated. Two airfoil construction techniques, bonded and wafer, were the principal designs considered. In the bonded construction, two airfoil sections having intricate internal cooling configurations are bonded together to form a complete blade or vane. In the wafer construction, a larger number (50 or more) of wafers having intricate cooling flow passages are bonded together to form a complete blade or vane. Of these two construction techniques, the bonded airfoil is considered to be lower in risk and closer to production readiness. A variety of industrial materials were evaluated for the turbine airfoils. A columnar grain nickel alloy was selected on the basis of strength and corrosion resistance. The bonded airfoil design yielded a 3.5 percent reduction in cost of electricity relative to a baseline Reliable Engine design. DOE

N81-27535# Bendix Corp., Kansas City, Mo.
SPEED AND PRESSURE CONTROL SYSTEM DESIGN AND SIMULATION FOR A COMPRESSION PRESS
R. H. Floersch Apr. 1981 65 p
(Contract DE-AC04-76DP-00613)
(BDX-613-2483) Avail: NTIS HC A04/MF A01

A new system design using closed loop control on the hydraulic system on compression transfer presses used to make filled elastomer parts will improve accuracy and repeatability of speed and pressure control during critical precure forming stages. The present open loop system does not provide the control necessary to mold repeatably the filled elastomer products. These products form with great difficulty because of high loading levels of filler materials. The new system will mean improved wall thickness control of loaded elastomer parts, thus reducing the amount of scrap caused by wall thickness variations. DOE

N81-27536# Northern Research and Engineering Corp., Woburn, Mass.
R AND D FOR IMPROVED EFFICIENCY SMALL STEAM TURBINES, PHASE 2 Quarterly Technical Report
Sep. 1980 103 p refs
(Contract DE-AC02-79ET-15426)
(DOE/ET-15426/T2; Rept-1380-3; QTR-1) Avail: NTIS HC A06/MF A01

The detailed aerodynamic design of the stage flowpath was completed except for the crossover piping from the first stage exhaust to the second stage inlet. In addition, mechanical design effort resulted in a definition of a rotor system. The detailed aerodynamic designs of the rotor blades, nozzle vanes, scroll and diffuser were based on the optimized geometry. The final blading selected for the stage is a radial design with 26 blades, 13 of which are splitters. Sixteen nozzle vanes were specified. The mechanical design of the rotor system included the specification of the rotor wheels and shafts with their polygon connection, and the design of the thrust and journal bearings and the gearing. In addition, various shaft sealing arrangements were evaluated, subject to the constraints indicated by initial rotordynamic analyses. The rotor system was designed for at least 100,000 hours life with the most severe operating conditions and loads. The system cannot be considered complete, however, until dynamic response of the rotors for all possible operating conditions is shown to be within acceptable limits. DOE

N81-27537# Central Electricity Generating Board, Harrogate (England). Scientific Services Dept.
SPRING-LOADED SPIDER GUIDE ASSEMBLY FOR COAL PULVERIZING MILLS
J. J. Bass Sep. 1980 7 p
(TDB-337; ISSN-0374-2784) Avail: NTIS HC A02/MF A01

The parallel wear plate is spring loaded onto the spider guide housing. The system reduces both shock loads on the mill and stresses set up in the fixing screws and bolts holding together the spider guide components. There are four equispaced spider guides and four pairs of loading rams. The loading rams are situated vertically in four equispaced pairs around the mill. The ram is loaded with nitrogen gas at a pressure of 47.5 bar. The ram bearing is lubricated with oil at a pressure of 58.3 bar which also acts as a seal for the gas. The whole spring assembly, including its bellows, can be built up in a workshop.

Author (ESA)

N81-27538# Kieserling und Albrecht Werkzeugmaschinenfabrik, Solingen (West Germany). Entwicklungsabteilung.
DEVELOPMENT OF A WIRE BRUSH FRAZING TOOL FOR SURFACE MACHINING HOT ROLLED BILLETS IN ORDER TO REDUCE DANGEROUS LOADING AND SO INCREASE JOB SAFETY Final Report
Rolf-Eckart Koch, Reiner Kahlhoefer, and Hans-Peter Wolf Bonn Bundesministerium fuer Forschung und Technologie Dec. 1980 76 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-HA-80-052; ISSN-0171-7618; BMFT-01-VC-106/TAP0004; KAW-102-885(6)) Avail: NTIS HC A05/MF 01

Surface machining hot rolled high quality steel billets in order to remove scale and surface defects (cracks) is discussed. The machining method most commonly used is high pressure grinding which can be dangerous for the operator. A microscalping process as an alternative machining method is considered. Author (ESA)

N81-27539# AEG-Telefunken, Heilbronn (West Germany). Geschaeftsbereich Halbleiter.
DEVELOPMENT OF BIPOLAR CIRCUITS FOR MONOLITHIC INTEGRATION APPLICATIONS Final Report
Heinz Rinderle Bonn Bundesministerium fuer Forschung und Technologie Nov. 1980 83 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-094; ISSN-0340-7608) Avail: NTIS HC A05/MF A01

Circuit design techniques, involving monolithic integrated bipolar circuits, are described. Industrial, communications, and general purpose applications are considered. Developed circuit functions include current and voltage source control, phase controlled signal generation, and electronic amplification control. Various designs, corresponding to different aspects of each of the functional categories, are presented. The design concepts are defined, circuit diagrams are given, and examples of integrated circuit layout are given. Author (ESA)

N81-27540# Grenzebach Maschinenbau G.m.b.H., Baeumenheim-Hamlar (West Germany).
DEVELOPMENT OF MICROPROCESSOR CONTROL UNITS FOR A TEST MODEL GLASS CUTTING MACHINE Final Report
Siegfried Richter Bonn Bundesministerium fuer Forschung und Technologie Dec. 1980 48 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-127; ISSN-0340-7608; BMFT-NT-0829) Avail: NTIS HC A03/MF A01

The microprocessor unit controls all functions in practical operation. Equipment control is handled by microprocessor hardware which follows an ASSEMBLER program. This software enables the input of positioning commands, according to desired cutting patterns for the glass cutting machine, through a keyboard with an LED display on the control desk of the equipment. In order to be able to test the cutting program or any other machine program for possible errors, a program testing device was also developed which shows the individual program functions by means of toggle switches and display. Author (ESA)

N81-28041# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
BRAKING OF AN AIRCRAFT TYRE
Louis Anquez and Andre Monthulet *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1981-1, Jan. - Feb. 1981 (ESA-TT-693) May 1981 p 15-35 refs Transl. by ONERA into ENGLISH from La Rech. Aerospatiale, Bull. Bimensel (Paris), no. 1981-1, Jan. - Feb. 1981 (For primary document see N81-28038 18-99) Avail: NTIS HC A04/MF A01; original FRENCH report available at ONERA, Paris FF 45

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N81-27541*# Ohio State Univ., Columbus. Dept. of Engineering Mechanics.
FUNDAMENTAL ASPECTS IN THE QUANTITATIVE ULTRASONIC DETERMINATION OF FRACTURE TOUGHNESS: GENERAL EQUATIONS Final Report
L. S. Fu Washington NASA Jul. 1981 30 p refs
(Grant NsG-3269)
(NASA-CR-3445) Avail: NTIS HC A03/MF A01 CSCL 14D

The problem of establishing a theoretical groundwork for experimentally-found correlations between ultrasonic and fracture toughness factors in polycrystalline metals is discussed. It is noted that the link between these material properties and ultrasonic factors are the microstructural parameters that interact with stress wave propagation during deformation and fracture. The dynamic response of material inhomogeneities and the strains and displacements they undergo under incident stress waves are considered. Dynamic strains and displacements inside and outside scatterers are treated. The underlying approach, the formulation and governing equations for the eigenstrains, and the determination of the energy due to the presence of inhomogeneities are presented. The stress wave interaction problem is presented in terms of the dynamic eigenstrain concept. M.G.

N81-27542# Wisconsin Univ. - Madison. Dept. of Statistics.
LIFE TESTING AND RELIABILITY WITH APPLICATION IN ENGINEERING SYSTEMS Final Report, 1 Oct. 1978 - 30 Sep. 1980
Richard A. Johnson and Gouri K. Bhattacharyya 28 Apr. 1981 6 p refs
(Contract N00014-78-C-0722)
(AD-A099568; ARO-15660.4-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

This report presents a summary of our research under the project entitled 'Life testing and reliability with applications in engineering systems.' Directions of our major advances include: an extension of the classical stress-strength reliability analyses so as to include informations on the covariates; efficiency studies of the modified least squares estimator's in accelerated life tests; inferences to compare two exponential distributions with jointly censored samples; study of moment properties of the hazard-rate functions and evaluation of the exact Fisher information in censored data; study of the properties of Box-Cox transformations in light of Kullback-Liebler information, and providing guidance for the choice of a transformation of life data towards improved model fitting and inferences. Author (GRA)

N81-27543# Engins Matra, Velizy (France).
RELIABILITY GROWTH THEORY AND ITS APPLICATION TO A PROJECT [CROISSANCE DE LA FIABILITE THEORIE ET MISE EN OEUVRE DANS LE CADRE D'UN PROJET]
J. Ringler 23 Jun. 1980 25 p refs In FRENCH
Avail: NTIS HC A02/MF A01

Reliability growth theory is discussed as a tool with which contractual reliability specifications on equipment to be developed can be met. The concept reliability growth hinges on the mathematical representation of the tendency for operational reliability to approach previsional reliability as a function of time or of the progression of development stages. The Duane model of reliability growth is presented. Project management which takes into consideration reliability growth curves, resultant of a properly posed reliability growth model, is described. The planning of a reliability control program which allows verification of predicted reliability growth is then treated. Author (ESA)

N81-27544# Engins Matra, Velizy (France).
PROCESSING INFORMATION COLLECTED AS A RESULT OF MAINTENANCE PROCEDURES MAKING UP A PROGRAM [TRAITEMENT DE L'INFORMATION RESULTANT DES TRAVAUX DE MAINTENANCE SITUES DANS LE CADRE D'UN PROGRAMME]

M. Deschamps 7 Feb. 1980 16 p In FRENCH
(N-FIT-772) Avail: NTIS HC A02/MF A01

Computerized detection of faulty behavior in missile sytems is formalized. Compilation and content of resulting maintenance worksheets is described. The informative value of maintenance data is established to: (1) to assure a sufficient probability that a missile functions effectively; and (2) monitor the cost of maintenance as well as to identify means of reducing cost if necessary. A missile lot is considered. Given that all the missiles must operate under the same conditions, the relative failure rates, which are comparable with previsional reliability test results, are calculated for each component and subsystem. The chronological classification of the data (failure, with or without repair) allows for reliability determination for the missile lot, based on a population model. Author (ESA)

N81-27545# Engins Matra, Velizy (France).
APROPROS TO THE DEFINITION OF RELIABILITY [A PROPOS DE LA DEFINITION DE LA FIABILITE]
M. Deschamps 1980 6 p In FRENCH
(N-FIT-835) Avail: NTIS HC A02/MF A01

The appropriateness of a scientific (mathematical) definition of system reliability is considered. The equitable specification of reliability as a design criterium is examined. Outright dependence on performance quantification is shown to lead to ambiguities, if not abuses of common sense. The probabilities of various causes of system degradation are examined, and the concept of maintainability is introduced. It is postulated that when required performance is explicit and quantifiable, then technical reliability can be the percentage of performance at which economical maintenance is assured. Author (ESA)

N81-27546# National Bureau of Standards, Washington, D.C. National Measurement Lab.
PROCEEDINGS OF THE WORKSHOP ON EDDY CURRENT NONDESTRUCTIVE TESTING Final Report
George M. Free Jan. 1981 168 p refs Workshop held at Gaithersburg, Md., 3-4 Nov. 1977
(PB81-166654; NBS-SP-589; LC-80-600172) Avail: NTIS HC A08/MF A01 CSCL 14B

A historical overview of the eddy current testing from its inception until the present is given. The following topics are discussed: the use of eddy current testing in the primary metals industry (both ferrous and nonferrous metals); use of eddy currents for the sorting of metals and for defect detection; state of the art in eddy current instrumentation; and the use of signal processing in the analysis of eddy current signals. The development and use of eddy current standards is discussed as well as several of the newer areas of eddy current development, i.e., multifrequency and pulsed eddy current techniques. GRA

N81-27468*# Naval Material Command, Washington, D. C. Dept. of Material for Reliability and Maintainability and Quality Assurance.
MANAGEMENT OF RELIABILITY AND MAINTAINABILITY; A DISCIPLINED APPROACH TO FLEET READINESS
Willis J. Willoughby, Jr. *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 13-55 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 14D

N81-27469*# Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
RELIABILITY ACHIEVEMENT IN HIGH TECHNOLOGY SPACE SYSTEMS
Dean L. Lindstrom *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 57-67 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 14D

N81-27470*# General Dynamics Corp., Pomona, Calif.
APPROACH TO RELIABILITY WHEN APPLYING NEW TECHNOLOGIES
John C. Bear *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 69-79 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 14D

N81-27471*# Honeywell, Inc., Minneapolis, Minn. Reliability Dept.
RELIABILITY AND THE DESIGN PROCESS AT HONEYWELL AVIONICS DIVISION
Alex Bezat *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 81-97 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 14D

N81-27481*# Rockwell International Corp., Anaheim, Calif. Defense Electronics Operations Div.
CONTRACTOR POINT OF VIEW FOR SYSTEM DEVELOPMENT AND TEST PROGRAM
Frank K. Koide, D. E. Ringer, and C. E. Earl *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 291-304 (For primary document see N81-27467 18-36)
Avail: NTIS HC A99/MF A01 CSCL 14D

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N81-27547*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPARISON OF ANALYSIS AND FLIGHT TEST DATA FOR A DRONE AIRCRAFT WITH ACTIVE FLUTTER SUPPRESSION
Jerry R. Newsom and Anthony S. Pototzky Jun. 1981 12 p refs Presented at AIAA Dynamics Specialist Conf., Atlanta, 8-11 Apr. 1981
(NASA-TM-83145; AIAA-81-0640) Avail: NTIS HC A02/MF A01 CSCL 20K

A drone aircraft equipped with an active flutter suppression system is considered with emphasis on the comparison of modal dampings and frequencies as a function of Mach number. Results are presented for both symmetric and antisymmetric motion with flutter suppression off. Only symmetric results are given for flutter suppression on. Frequency response functions of the vehicle are presented from both flight test data and analysis. The analysis correlation is improved by using an empirical aerodynamic correction factor which is proportional to the ratio of experimental to analytical steady-state lift curve slope. The mathematical models are included and existing analytical techniques are described as well as an alternative analytical technique for obtaining closed-loop results. A.R.H.

N81-27548*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
WIND-TUNNEL EVALUATION OF NASA DEVELOPED CONTROL LAWS FOR FLUTTER SUPPRESSION ON A DC-10 DERIVATIVE WING
I. Abel and Jerry R. Newsom Jun. 1981 14 p refs Presented at the AIAA Dyn. Spec. Conf., Atlanta, 8-11 Apr. 1981
(NASA-TM-83143; AIAA-Paper-81-0639) Avail: NTIS HC A02/MF A01 CSCL 20K

Two flutter suppression control laws were synthesized, implemented, and tested on a low speed aeroelastic wing model of a DC-10 derivative. The methodology used to design the control laws is described. Both control laws demonstrated increases in flutter speed in excess of 25 percent above the passive wing flutter speed. The effect of variations in gain and phase on the closed loop performance was measured and compared with analytical predictions. The analytical results are in good agreement with experimental data. Author

N81-27549*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

COMPUTER PROGRAM FOR NONLINEAR STATIC STRESS ANALYSIS OF SHUTTLE THERMAL PROTECTION SYSTEM: USER'S MANUAL

Gary L. Giles and Maria Wallas May 1981 58 p refs
(NASA-TM-81856) Avail: NTIS HC A04/MF A01 CSCL 20K

User documentation is presented for a computer program which considers the nonlinear properties of the strain isolator pad (SIP) in the static stress analysis of the shuttle thermal protection system. This program is generalized to handle an arbitrary SIP footprint including cutouts for instrumentation and filler bar. Multiple SIP surfaces are defined to model tiles in unique locations such as leading edges, intersections, and penetrations. The nonlinearity of the SIP is characterized by experimental stress displacement data for both normal and shear behavior. Stresses in the SIP are calculated using a Newton iteration procedure to determine the six rigid body displacements of the tile which develop reaction forces in the SIP to equilibrate the externally applied loads. This user documentation gives an overview of the analysis capabilities, a detailed description of required input data and an example to illustrate use of the program. Author

N81-27550*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

MISSION LOAD DYNAMIC TESTS OF TWO UNDENSIFIED SPACE SHUTTLE THERMAL PROTECTION SYSTEM TILES

Jack D. Leatherwood and Joe C. Gowdey Jun. 1981 52 p refs
(NASA-TM-83148) Avail: NTIS HC A04/MF A01 CSCL 20K

Two tests of undensified Space Shuttle thermal protection tiles under combined static and dynamic loads were conducted. The tiles had a density of approximately 144 Kg/cum (LI900 tiles) and were mounted on a strain isolation pad which was 0.41 cm (.160 inch) thick. A combined static and dynamic mission stress histogram representative of the W-3 area of the wing of the orbiter vehicle was applied. The stress histogram was provided by the space shuttle project. Results presented include: tabulation of measured peak and root-mean-square (RMS) accelerations in both compression and tension; peak SIP stress in compression and tension, peak and RMS amplitude response ratios; lateral to vertical response ratios; response time histories; peak stress distributions (histograms), and SIP extension measured both with and without static tension at various mission times. A.R.H.

N81-27551*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

PASCO: STRUCTURAL PANEL ANALYSIS AND SIZING CODE. CAPABILITY AND ANALYTICAL FOUNDATIONS

W. Jefferson Stroud and Melvin S. Anderson Jan. 1980 74 p refs
(NASA-TM-80181) Avail: NTIS HC A04/MF A01 CSCL 20K

A computer code denoted PASCO which can be used for analyzing and sizing uniaxially stiffened composite panels is described. Buckling and vibration analyses are carrid out with a linked plate analysis computer code denoted VIPASA, which is incorporated in PASCO. Sizing is based on nonlinear mathematical programming techniques and employs a computer code denoted CONMIN, also incorporated in PASCO. Design requirements considered are initial buckling, material strength, stiffness, and vibration frequency. The capability of the PASC computer code and the approach used in the structural analysis and sizing are described. Author

N81-27552*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

PASCO: STRUCTURAL PANEL ANALYSIS AND SIZING CODE. USERS MANUAL

Melvin S. Anderson, W. Jefferson Stroud, Barbara J. Durling, and Kartherine W. Hennessy Jan. 1980 110 p refs
(NASA-TM-80182) Avail: NTIS HC A06/MF A01 CSCL 20K

A user's manual for the panel analysis and sizing (PASCO) is presented. The code can be used to analyze and size prismatic structures having an arbitrary cross section. Its primary focus is stiffened panels made of laminated orthotropic materials. This tool is of particular value in analyzing and sizing filamentary composite structures. A.R.H.

N81-27553# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.

INFLUENCE OF INITIAL GEOMETRICAL IMPERFECTIONS ON VIBRATIONS OF AXIALLY COMPRESSED STIFFENED CYLINDRICAL SHELLS

Josef Singer and Jacky Prucz Feb. 1980 114 p refs Sponsored in part by DFG in cooperation with RWTH Aachen.
(TAE-369) Avail: NTIS HC A06/MF A01

The vibrations of stiffened cylindrical shells having axisymmetric or asymmetric initial geometrical imperfections and axial preload are studied. The analysis is based on a solution of the Karman-Donnel nonlinear shell equations, an 'exact' solution of the compatibility equation, and a first order approximation by the Galerkin method of the equilibrium equation. The stiffeners are closely spaced and 'smeared' stiffener theory is employed. An extensive parametric study is carried out on shells similar to those used in vibration and buckling tests. The results show that stiffening of the shell will lower the imperfection-sensitivity of its free vibrations, but the decrease depends on the type of stiffening (stringer or rings), the mode shapes of the vibration and the imperfection, the stiffener strength and eccentricity. The imperfection-sensitivity decrease, caused by the stiffeners, is greater for vibration mode shapes with high imperfection-sensitivity than for other vibration mode shapes. Author

N81-27554# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.

A PHOTOELASTIC STUDY OF STRESSES IN SINGLE-GROOVE CONNECTIONS OF THE SAME MATERIAL

Y. F. Cheng Feb. 1981 37 p refs
(AD-A099396; AD-E440115; ARLCB-TR-81008) Avail: NTIS HC A03/MF A01 CSCL 20/11

This report describes a three-dimensional photoelastic study on stresses in single-groove connections of the same material. Two groove profiles were investigated; namely, the British standard buttress and the new profile. Boundary stresses, interior stresses, and contact stresses were determined. Shear-difference method was used and the procedure of the method was outlined. Appropriate checks for accuracy of the results were made. Heywood's empirical equation for calculating maximum fillet stress in loaded projections was reviewed. It was found that the British standard buttress is stronger than the new profile and that the Heywood's equation is not applicable in our problem. Further work on multi-groove connection is in progress. GRA

N81-27555# Forest Products Lab., Madison, Wis.

STRENGTH OF FASTENERS IN PARALLEL-LAMINATED VENEER

Joseph Jung and Judy Day Feb. 1981 22 p refs Sponsored by Dept. of Agriculture
(AD-A099011; FSRP-FPL-389) Avail: NTIS HC A02/MF A01 CSCL 13/5

Phase I of this study shows that the effects of lamina thickness and the degree of lathe checking could not be detected in either nail withdrawal or lateral loading. In Phase II, Parallel Laminated Veneer (PLV) from 3/16- and 4/10-inch Douglas-fir shows no severe reduction in fastening strength for bolts, staples, split rings, and truss plates. The only exception is for truss plates on 4/10-inch PLV. GRA

N81-27556# Michigan State Univ., East Lansing. Dept. of Metallurgy Mechanics and Materials Science.

AN EXPERIMENTAL STUDY OF THE INTERACTION OF STRAIN FIELDS BETWEEN COLDWORKED FASTENER HOLES Final Report, 1 Jul. 178 - 15 Feb. 1980

Gary Cloud and Mark Tipton Wright-Patterson AFB, Ohio AFWAL Mar. 1981 135 p refs
(Contract F33615-78-C-5123; AF Proj. 2418)
(AD-A099695; AFWAL-TR-80-4205) Avail: NTIS HC A07/MF A01 CSCL 11/6

This report describes the experimental study investigating the interaction of the residual surface strain fields caused by the coldworking of fastener holes in the near vicinity of one another. Testing was confined to 7075-T aluminum alloy, 1/4 inch

(6.4 mm) in thickness. Fastener holes were .261 inch (6.6 mm) in diameter and the center-to-center separation between adjacent fasteners was 1.75 and 2.0 diameters. Single-row in-line and double-row fastener patterns were the focus of this study. Consecutive and non-consecutive sequences of pattern coldwork were chosen to model possible field situations. Experimental results indicate a direct relation exists between the degree of interaction between strain fields and the center-to-center separation between adjacent fastener holes. As noted from the measurement of residual diametrical expansions, unsymmetric hole edge motions result in unsymmetric strain distributions. Sleeve failure and the coldwork of adjacent fastener holes can lead to unwanted residual tensile strains at a hole edge boundary.
Author (GRA)

N81-27557# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.

THE CORRELATION OF FRACTURE TOUGHNESS WITH CHARPY V-NOTCH IMPACT TEST DATA

S. Tauscher Mar. 1981 77 p refs
(AD-A099736; AD-E440117; ARLCB-TR-81012) Avail: NTIS HC A05/MF A01 CSCL 20/11

Fracture toughness data is compared with the Charpy V-notch impact data. The applicability of various regression models for showing the relationship of KIc with other mechanical properties is examined for gun steel. The types of material were classified by steel maker, type of forging, and location within the tube.
GRA

N81-27558# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Geotechnical Lab.

NONDESTRUCTIVE TESTING FOR LIGHT AIRCRAFT PAVEMENTS. PHASE 2: DEVELOPMENT OF THE NONDESTRUCTIVE EVALUATION METHODOLOGY Final Report, Aug. 1979 - Aug. 1980

Albert J. Bush, III Nov. 1980 125 p refs
(Contract DOT-FA78WAI-848)
(AD-A099593; FAA-RD-80-9-2) Avail: NTIS HC A06/MF A01 CSCL 13/2

This study is the second phase of a two-phase program to develop a nondestructive pavement evaluation method to evaluate pavements designed to support aircraft with gross weights of less than 30,000 lb. A method that uses the deflection basin from nondestructive testing (NDT) to predict the elastic moduli of up to four pavement layers was developed. A computer program (CHEVDEF) was developed that predicts the moduli so that the deflection basin from a layered elastic solution approximates the measured basin. The nonlinear stress-dependent characteristics of the subgrade are defined. Moduli derived from NDT results are used in the PAVEVAL program developed in FAA-RD-77-186-I by R. A. Weiss to predict the allowable aircraft loads. The subgrade elastic moduli described by this method compares well with laboratory test results and with results from other methodologies. The predicted allowable load from this method compares well with the allowable load from the dynamic stiffness modulus procedure. Appendices present a laboratory procedure for determining the resilient modulus of subgrade soils, discuss the CHEVDEF program, and provide a guide to the use of the PAVEVAL computer program.
GRA

N81-27559# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.

DIAMETRIC DISC AND STANDARD TENSILE-TEST CORRELATION STUDY. PROCESS DEVELOPMENT ENDEAVOR NO. 209

Herb D. Johnson Apr. 1981 12 p ref
(Contract DE-AC04-76DP-00487)
(MHSMP-81-22) Avail: NTIS HC A02/MF A01

The tensile and diametric disc ultimate stress-strain group means of fifteen lots of RX-03-BB material were used to determine the correlation between the standard tensile test and diametric disc tests. Statistical results show that the tensile/disc ultimate stress linear correlation coefficient was high (0.879) and the linear correlation coefficient for strain somewhat lower (0.568). Density variations as low as 0.020 Mg/m(3) significantly affected the diametric disc ultimate stress. The ultimate strain was not significantly affected within the limited density range (0.055 Mg/m(3)).
DOE

N81-27560# Engins Matra, Velizy (France).

CALCULATION OF FAILURE RATES FOR COMPONENTS IN LOGIC CIRCUITS AND MONOLITHIC INTEGRATED CIRCUITS IN THE ACTIVE MODE [CALCUL DU TAUX DE DEFAILLANCE DES COMPOSANTS DES CIRCUITS LOGIQUES ET INTEGRES MONOLITHIQUES EN MODE ACTIF]

M. Peiffer 14 Mar. 1980 39 p refs In FRENCH
(N-FIT-789) Avail: NTIS HC A03/MF A01

A computerized calculation method which gives the failure rates for microelectronic components in the active mode is presented. Monolithic linear and digital integrated circuits, logic circuits, and microprocessors are described. The systematic calculation of failure rate, using a computer program implemented on a Tektronix 4051, is explained. Circuit characteristics which are necessary to define the calculation are discussed, e.g., number of package leads, number of bits for a memory, transistors for a linear integrated circuit, or gates for a microprocessor. The calculation considers level of quality, ambient temperature and operating environment. A program package, based on this method, which is used to update a file of reliability predictions for electronic components is mentioned as available.
Author (ESA)

N81-27561# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

INFLUENCE OF ENVIROMENTAL AGEING AND DISPLACEMENT RATE ON CRACK RESISTANCE OF ADHESIVES, AS DETERMINED ON ADHESIVE BONDED TAPERED DOUBLE CANTILEVERED BEAM SPECIMENS

J. Lameris 27 Jun. 1980 95 p refs
(Contract NIVR-312.4-1722)
(NLR-TR-78147-U) Avail: NTIS HC A05/MF A01

Fracture toughness measurements were carried out to test the aging behavior of three adhesives in different environments. Metlbond 328, EC 2216 and REDUX 775 were tested on precracked 16 mm aluminum alloy (2024) plates in air at 90% relative humidity at 293 K and 373 K up to 4 weeks. Chromic sulfuric acid etching followed by chromic or phosphoric acid anodizing were the surface treatments used. Constant displacement rate tests were carried out to determine crack growth resistance R. Constant crack opening displacement tests were made to determine crack extension and crack growth resistance. It was possible to compare and evaluate adhesives and surface pretreatments. Phosphoric acid anodizing resulted in different durabilities for the adhesives. For a rate sensitive adhesive high displacement rates resulted in large crack extensions and high cracking rates.
Author (ESA)

N81-27562# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

A SIMPLE ANALYTICAL MODEL FOR COMPUTATION OF SPECIMEN COMPLIANCE AND EFFECTIVE CRACK EXTENSION IN A CENTRALLY CRACKED STRIP, INCLUDING EFFECTS OF YIELDING

A. U. Dekoning Jun. 1979 20 p refs
(Contract NIVR-1815)
(NLR-TR-79062-U) Avail: NTIS HC A02/MF A01

A model based on the classical solution for a cracked infinite sheet under uniaxial tension is presented. The effect of finite specimen width on the net section stress distribution is taken into account by a correction factor depending only on the crack aspect ratio. An effective crack length concept is introduced to account for plasticity affects. The crack extension force value obtained for the net section yield is twice that obtained using linear elastic fracture mechanics. Formulas are derived for compliance, grip displacements, crack opening displacements, and the crack extension force.
Author (ESA)

N81-27563# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

EFFECTS OF VARIATIONS IN GUST SPECTRUM AND GROUND LOAD LEVEL ON FATIGUE LIFE AND CRACK PROPAGATION

A. Nederveen, J. B. deJonge, and P. J. Tromp 21 Jan. 1980 46 p refs

(Contracts RB-RLD-79.017; NIVR-1822)
(NLR-TR-80009-U) Avail: NTIS HC A03/MF A01

The effects of systematic variations in mean stress levels, gust spectra and ground load severity on riveted specimens (fatigue life) and sheet specimens with central saw cuts (crack growth) were investigated in a flight test simulation program. All tests were carried out under load control in a 250 kN servo hydraulic testing machine. The fatigue and crack propagation lives of Alclad 2024-T3 were found to be much longer than those of Alclad 7075-T6 at the same stress level. Alclad 2024-T3 is more sensitive to changes in mean stress levels and somewhat more sensitive to gust amplitude severity and ground stress variations.
Author (ESA)

N81-27564# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
OVERALL BUCKLING OF Z-STIFFENED PANELS IN COMPRESSION
A. vanderNeut Aug. 1980 42 p refs
(VTH-LR-303) Avail: NTIS HC A03/MF A01

A simple analytical method for establishing critical load and mode is described. Particular mention is given to deformation by shear load. Numerical illustrations are presented which refer the flanges, one having symmetric flanges. The critical load appears to depend very much on the stiffness of restraint offered by the panel plate to the root of the stiffener web. Author (ESA)

N81-28042# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
AN ECONOMIC METHOD FOR CALCULATING PRECISE STRESS. LOCATION OF MODELING ERRORS
Philippe Gibert and Yves Gorge *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1981-1, Jan. - Feb. 1981 (ESA-TT-693) May 1981 p 37-45 refs Transl. by ONERA into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris), no. 1981-1, Jan. - Feb. 1981 (For primary document see N81-28038 18-99) Avail: NTIS HC A04/MF A01; original FRENCH report available at ONERA, Paris FF 45

N81-28043# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Structures Dept.
THE PRINCIPLE OF COMPLEMENTARY ENERGY IN NONLINEAR SHELL THEORY
Roger Valid *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1981-1, Jan. - Feb. 1981 (ESA-TT-693) May 1981 p 47-57 refs Transl. by ONERA into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris), No. 1981-1, Jan. - Feb. 1981 Presented at 5th Intern. Congr. of Theory and Appl. Mech., Toronto, 17-23 Aug. 1980 (For primary document see N81-28038 18-99) Avail: NTIS HC A04/MF A01; original FRENCH report available at ONERA, Paris FF 45

42 GEOSCIENCES (GENERAL)

N81-27565# Army Military Personnel Center, Alexandria, Va.
TEMPORAL, DIRECTIONAL, AND SPATIAL VARIABILITY OF WET DEPOSITION IN THE NORTHEASTERN UNITED STATES Ph.D. Thesis. Final Report
Jerre W. Wilson 23 Apr. 1981 182 p refs
(AD-A099738) Avail: NTIS HC A09/MF A01 CSCL 04/1

The precipitation chemistry data base of the Multistate Atmospheric Power Production Pollution Study and the National Atmospheric Deposition Program were examined for temporal, directional, and spatial variability of wet deposition of the dominant ions in precipitation for selected sites in the northeastern United States. Sulfate, hydrogen, and ammonium ions exhibited a distinct summer maxima in both concentration and deposition, while nitrate remained relatively constant throughout the years 1977-1979. Linear regression analysis applied to the three-year cumulative totals was found to provide a reasonable wet deposition predictive capability. The Air Resources Laboratories--Atmospheric Transport and Dispersion trajectory model was used to examine directional variability and to characterize individual events as to air mass origin. Case studies were examined to illustrate variability in the chemical quality of precipitation from air masses passing over distinctly different regions in the United States and Canada. The directional variability in wet deposition of all ions was found to coincide with the distribution of precipitation. The data of the MAP3S and NADP networks for 1979 were also used to develop spatial distributions of normalized and estimated wet deposition for the eastern United States. A rather uniform pattern in normalized wet deposition for sulfate and nitrate emerges, lending support to the concept that the deposition of these materials is not confined to any particular region. GRA

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N81-27566*# Purdue Univ., Lafayette, Ind. Dept. of Geosciences.
[ANALYZING AND MODELING GRAVITY AND MAGNETIC ANOMALIES USING THE SPHERE PROGRAM AND MAGSAT DATA] Quarterly Progress Report, Jan. - Mar. 1981
L. W. Braile, W. J. Hinze, and R. R. B. vonFrese, Principal Investigators 30 Mar. 1981 2 p Sponsored by NASA ERTS (E81-10098; NASA-CR-164096) Avail: NTIS HC A02/MF A01 CSCL 08E

Computer codes were completed, tested, and documented for analyzing magnetic anomaly vector components by equivalent point dipole inversion. The codes are intended for use in inverting the magnetic anomaly due to a spherical prism in a horizontal geomagnetic field and for recomputing the anomaly in a vertical geomagnetic field. Modeling of potential fields at satellite elevations that are derived from three dimensional sources by program SPHERE was made significantly more efficient by improving the input routines. A preliminary model of the Andean subduction zone was used to compute the anomaly at satellite elevations using both actual geomagnetic parameters and vertical polarization. Program SPHERE is also being used to calculate satellite level magnetic and gravity anomalies from the Amazon River Aulacogen. A.R.H.

N81-27567*# National Aeronautics and Space Administration, Washington, D. C.
LANDSAT'S ROLE IN HUD 701 PROGRAMS
Oct. 1979 15 p Prepared in cooperation with the Council of State Planning Agencies, Washington, D.C. ERTS (E81-10146; NASA-TM-82383) Avail: NTIS HC A02/MF A01 CSCL 05B

A survey of states concerning the use of LANDSAT in support of the comprehensive planning assistance program (Title IV, section 701) of the Housing and Community Development Act (1974) which is aimed mostly at small communities and rural counties, shows: (1) state governments used or were aware of the application of LANDSAT for inventorying land use and land cover at the state and local level; (2) use of satellite data was associated with the development of automated geographic information systems and the computer capability of handling and analyzing mapped information and other data tied to geographic coordinates and boundaries; and (3) LANDSAT capabilities in states tend to be institutionalized within state government information services where they can be readily assessed by state agencies. A summary of the state program for New Jersey and South Dakota is presented along with the state development guide plans, the rationale for using the satellite, and potential applications. A.R.H.

N81-27568*# National Aeronautics and Space Administration, Washington, D. C.
LANDSAT'S ROLE IN STATE COASTAL MANAGEMENT PROGRAMS
Oct. 1979 18 p Prepared in cooperation with the Council of State Planning Agencies, Washington, D.C. ERTS (E81-10147; NASA-TM-82381) Avail: NTIS HC A02/MF A01 CSCL 08C

The framework for state programs found in the Coastal Zone Management Act and examples of state opportunities to use LANDSAT are presented. Present activities suggest that LANDSAT remote sensing can be an efficient, effective tool for land use planning and coastal zone management. A.R.H.

N81-27569*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PROSPECTS FOR TLRS BASELINE ACCURACIES IN THE WESTERN USA

D. Christodoulidis (EG/G Washington Analytical Services Center, Inc., Riverdale, Md.) and David E. Smith Apr. 1981 45 p refs Submitted for publication

(Contract NAS5-26012)

(NASA-TM-82133) Avail: NTIS HC A03/MF A01 CSCL 08E

One of the main goals of the LAGEOS satellite mission is the detection of regional geotectonic movements. A parametric study with the intention to obtain the optimal baseline precision from dynamic solutions of laser ranging to LAGEOS is presented. The varied parameters are: length of reduced arc, number of tracking stations, data noise and rate, biases, refraction errors, system efficiency, gravity model errors in the value of GM. The baseline precisions are 1-10 cm depending upon the set of parameters adopted. General principles obtained are also presented. Author

N81-27570*# Hydex Corp., Fairfax, Va.

REVIEW OF HYDROLOGIC MODELS FOR EVALUATING USE OF REMOTE SENSING CAPABILITIES Interim Report, Feb. - Mar. 1981

E. L. Peck, R. McQuivey, T. Keefer, E. R. Johnson, and J. Erekson 31 Mar. 1981 93 p refs

(Contract NAS5-26446)

(NASA-CR-166674) Avail: NTIS HC 05/MF A01 CSCL 08H

Hydrologic models most commonly used by federal agencies for hydrologic forecasting are reviewed. Six catchment models and one snow accumulation and ablation model are reviewed. Information on the structure, parameters, states, and required inputs is presented in schematic diagrams and in tables. The primary and secondary roles of parameters and state variables with respect to their function in the models are identified. The information will be used to evaluate the usefulness of remote sensing capabilities in the operational use of hydrologic models. Author

N81-27571# European Space Agency, Paris (France).

SATELLITE REMOTE SENSING. APPLICATIONS TO RURAL DISASTERS

1981 182 p refs Partly in ENGLISH and FRENCH Proceedings of the Joint ESA/FAO/WMO Intern. Training Course, Rome, 27 Oct. - 7 Nov. 1980

(ESA-SP-1035; RSC-Ser-5/80; ISSN-0379-6566) Avail: NTIS HC A09/MF A01

Emphasis is placed on international disaster relief and remote sensing applied to rural disasters in developing countries. Basic principles of remote sensing are presented along with equipment description and performance data. Environmental data relay via satellite (e.g., Argos) and environmental monitoring are discussed. Synoptic observation of tropical storms, rainfall, and snow cover are considered. Flood mapping and earthquake damage assessment are also addressed. For individual titles, see N81-27572 through N81-27591.

N81-27572# United Nations Disaster Relief Office, Geneva (Switzerland).

INTERNATIONAL DISASTER RELIEF AND THE ROLE OF THE UNITED NATIONS DISASTER RELIEF

L. Walter *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 5-6 (For primary document see N81-27571 18-43)

Avail: NTIS HC A09/MF A01

The application of satellites to rural disasters is introduced. The scope of the problem of disaster relief, is defined from the viewpoint of the Office of the United Nations Disaster Relief Co-ordinator (UNDRO). Among the most severe disasters which strike rural areas are floods, famine, storms, earthquakes, volcanic eruptions and epidemic disease. The multiple facits of these disasters complicate the process of anticipating and providing relief. In this process, UNDRO plays three roles: (1) it performs the role of coordination among donor countries, especially by providing channels of communication; (2) it seeks ways to develop and implement plans to enable countries to withstand disasters; and (3) UNDRO works to develop and implement plans through which the disastrous effects of natural phenomena can be avoided or mitigated. Many of these objectives can be facilitated through improved information and communication provided by satellite technology. Author (ESA)

N81-27573# Food and Agriculture Organization of the United Nations, Rome (Italy).

FOOD AND AGRICULTURAL ORGANIZATION OF THE UNITED NATIONS OFFICE FOR SPECIAL RELIEF OPERATIONS (OSRO)

K. P. Wagner *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 7-12 (For primary document see N81-27571 18-43)

Avail: NTIS HC A09/MF A01

The nature of assistance provided through OSRO in response to request for emergency aid in the agricultural, livestock and fishery sectors, from many parts of the world, is described. Activities include: agro-economic assessment and monitoring of emergency requirements and supply; carrying out relief and rehabilitation operations, e.g., provision of feed supplies, agricultural equipment, transport and storage facilities, breeding animals for livestock rehabilitation; and planning for disaster preparedness and prevention. Starting in the Sahelian countries in 1973, OSRO organized or participated in over 60 missions, involving 21 different countries by September 1980. Author (ESA)

N81-27574# Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Centre.

SATELLITE REMOTE SENSING APPLIED TO RURAL DISASTERS IN DEVELOPING COUNTRIES

J. A. Howard and A. vanDijk *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 13-19 refs (For primary document see N81-27571 18-43)

Avail: NTIS HC A09/MF A01

The need for the application of advanced technologies to help overcome rural problems in the developing countries is discussed. It is particularly for warning of uncertainties and assessment of rural disasters that satellite remote sensing is seen to have an increasingly important role to play in the near future. Three types of satellites (polar orbiting earth resources; polar orbiting environmental; geostationary environmental) are considered. The application of satellite sensing to rural disasters is conveniently classified according to the time needed for the impact of the disaster to be felt. Short-term disasters are viewed as the easiest to monitor by satellite remote sensing. Some FAO examples are given. These include: the FAO Experimental Desert Locust Survey Program; floods in the Sudan; floods in Pakistan; and monitoring drought in south Africa. Author (ESA)

N81-27575# Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Centre.

BASIC PRINCIPLES OF REMOTE SENSING

A. VanDijk *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 21-24 (For primary document see N81-27571 18-43)

Avail: NTIS HC A09/MF A01

The general flow of remote sensing data from airborne or satellite sensors to the data/imagery user is traced. This includes data collection, preprocessing, processing and interpretation. The most important spectral windows for Earth observations are identified, and their uses are described. Image enhancement and processing are shown by an example from LANDSAT multispectral reconnaissance in four bands. Image interpretation is also illustrated, citing LANDSAT techniques. Author (ESA)

N81-27576# European Space Agency, Toulouse (France).

A SURVEY OF EARTH OBSERVATION SPACE SYSTEMS

P. Louis *In its* Satellite Remote Sensing Appl. to Rural Disasters 1981 p 25-39 (For primary document see N81-27571 18-43)

Avail: NTIS HC A09/MF A01

Earth observation space systems which use satellites, are considered, including the general features of such systems.

Thematic applications of observations from space are discussed relative to the spectral windows offered by the atmosphere. Space systems requirements and constraints are discussed, stressing orbits, payloads and platforms, data acquisition, preprocessing, archiving and distribution of products to data user stations. The METEOSAT system is described as an example. Author (ESA)

N81-27577# Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Centre.

SATELLITE IMAGERY AND RELATED SENSORS

Carlo Travaglia, comp., Bryan Bayley, and C. Trautwein *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 41-43 refs (For primary document see N81-27571 18-43)

Avail: NTIS HC A09/MF A01

Basic principles of imagery analysis and interpretation are explained together with a logical work sequence to obtain meaningful image interpretation. Synoptic view, repetitivity and integrated approach concepts are given. The most widely used imaging instruments in satellite sensing are the multispectral scanner (MSS) and the return beam vidicon (RBV) which are both carried by LANDSAT satellites. However, it is generally agreed that MSS images are equal or superior in quality to those from the RBV. As examples, LANDSAT imagery availability and formats are considered. Author (ESA)

N81-27578# European Space Operations Center, Darmstadt (West Germany). Meteosat Data Management Dept.

ENVIRONMENTAL DATA RELAY VIA SATELLITE

A. Robson *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 45-49 (For primary document see N81-27571 18-43)

Avail: NTIS HC A09/MF A01

Data collection systems, using Earth exploration satellites, are discussed. The systems are explained with particular emphasis on the METEOSAT geosynchronous system. Current applications, supporting a range of disciplines, are reviewed in order to demonstrate the general applicability of the system to a wide range of data collection problems. Author (ESA)

N81-27579# Centre National d'Etudes Spatiales, Toulouse (France). Service ARGOS.

ACTUAL PERFORMANCE OF THE ARGOS SYSTEM

J. L. Bessis *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 51-60 (For primary document see N81-27571 18-43)

Avail: NTIS HC A09/MF A01

The ARGOS platform location, data collection and distribution system is described. The ARGOS system comprises: user platforms equipped with sensors and platform transmitter terminals; a space segment consisting of two satellites in orbit at any one time during the operational phase; and a data processing and results distribution center located in Toulouse, France. The Tiros-N and NOAA-6 orbit characteristics are given. Data collection is discussed as to the elementary probability of message acquisition and bit error rate. The principle of platform location is explained, and location accuracy is specified. Operational data processing is discussed including the interval between data collection and availability. Current applications of the ARGOS system are summarized. Author (ESA)

N81-27580# Comision Nacional de Investigaciones Espaciales, Buenos Aires (Argentina).

AUTOMATIC COLLECTION SYSTEMS FOR SATELLITE ENVIRONMENTAL DATA IN ARGENTINA

Oscar E. Marsano *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 61-68 (For primary document see N81-27571 18-43)

Avail: NTIS HC A09/MF A01

A project which demonstrates the application and utility of relaying data from various sensors via the Geostationary Operational Environmental Satellite (GOES) system to users in Argentina is presented. The GOES data collection system (DCS) is described, and data collection platform operation is specified. In reference to user requirements dictated by the Argentine government, GOES DCS data distribution performance is reported. Fields of application cover agriculture, livestock breeding, hydroelectric resources, snow and ice reporting as well as water management, solar research, and seismology. Author (ESA)

N81-27581# Direction de la Meteorologie Nationale, Paris (France).

TROPICAL DISTURBANCES [PERTURBATIONS TROPICALES]

G. Dhonneur *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 69-77 refs In FRENCH (For primary document see N81-27571 18-43)

Avail: NTIS HC A09/MF A01

The surveillance of tropical storms, particularly hurricanes, is discussed, and appropriate actions both on a regional and national scale are discussed. The need for accurate meteorological data when making forecasts is brought out. Application of specialized radar for in situ aerial reconnaissance is considered, and interpretation of satellite imagery is covered. Concepts of tropical meteorology are reviewed, relating to image analysis. Hurricane climatology and cyclogenesis are treated. A classification of tropical disturbances is formulated. Hurricane direction and storm intensity forecasting are described. Author (ESA)

N81-27582# National Environmental Satellite Service, Washington, D. C.

METHODS FOR TROPICAL CYCLONE INTENSITY ANALYSIS AND FORECASTING USING SATELLITE DATA

Vernon F. Dvorak *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 79-87 refs Presented also at WMO/ESCAP Typhoon Symp., Shanghai, 6-11 Oct. 1980 Submitted for publication (For primary document see N81-27571 18-43)

Avail: NTIS HC A09/MF A01

The use of satellite imagery for monitoring tropical storms is reviewed. A technique which provides reliable intensity estimates each day from a series of pictures instead of relying on the features observed in just one picture is presented. The analysis procedure includes: (1) locating the cloud system center and classifying the storm based on cloud patterns; (2) measuring the changes in spiral banding and cloud-top temperature; and (3) using a tropical cyclone development model which was empirically developed based on 15 years of data. This is an analysis procedure for both visible and infrared data. It gives a storm classification T-number which relates empirically to the central sea level pressure of the storm and to the maximum wind. Satellite pictures are used to detect the initial stages of tropical cyclone development before a storm reaches tropical storm intensity. A 24 hour storm intensity forecast is also possible by extrapolating forward along the modeled growth (or weakening) curve of the storm. Author (ESA)

N81-27583# Bristol Univ. (England). Dept. of Geography.

SATELLITE-IMPROVED MONITORING OF RAINFALL

Eric C. Barrett *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 89-95 refs (For primary document see N81-27571 18-43)

Avail: NTIS HC A09/MF A01

The distinction is drawn between environmental hazards and disasters. Rainfall is seen to be a significant hazard sometimes leading to disasters in rural areas. Satellite remote sensing of rainfall is discussed in terms of principles of improved rainfall monitoring by satellite. Methods are presented with special attention paid to the Bristol Method of improved rainfall monitoring. A manual cloud-indexing method which has been applied successfully to the monitoring of rainfall for a wide variety of purposes in several regions of the world, mainly within the tropics is discussed. Author (ESA)

N81-27584# Bristol Univ. (England). Dept. of Geography.

SATELLITE MONITORING OF EXTREME RAINFALL EVENTS

Eric C. Barrett *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 97-103 refs (For primary document see N81-27571 18-43)

Avail: NTIS HC A09/MF A01

Extreme rainfall events are caterogized in terms of the lengths of time taken for them to develop to severe hazard or disaster proportions. Examples are given of satellite methods for improved monitoring and assessment of slowly developing droughts, rainfall surpluses, and floods associated with sudden, high intensity rainfall events. Concluding references are made to satellite-improved monitoring of some key hydrological variables

related to rainfall, e.g., stream hydrograph peaks and basin runoff changes. Author (ESA)

N81-27585# Bristol Univ. (England). Dept. of Geography.
SATELLITE MONITORING OF CONDITIONS CONDUCIVE TO THE UPSURGE OF INSECT PESTS
Eric C. Barrett *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 105-111 refs (For primary document see N81-27571 18-43)
Avail: NTIS HC A09/MF A01

Reference is made to a variety of insect pests which are, or probably could be, monitored better through satellite assisted environmental assessments. Special attention is paid to the screw worm (a temperature sensitive cattle pest) in Mexico and the southern USA, the desert locust (a traditional rainfall dependent agricultural pest) in northwest Africa, and the armyworm (a pest possibly influenced by mesoscale convective outbreaks) in eastern Africa. It is seen that the most efficient and cost affective uses of satellite data for the monitoring and control of insect pests lies in centralization of satellite facilities and the simultaneous use of their data for a wide variety of purposes. Author (ESA)

N81-27586# Norwegian Water Resources and Electricity Board, Oslo.
SNOW MELT WATER RUN-OFF PREDICTION
Gunnar Oestrem *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 113-114 (For primary document see N81-27571 18-43)
Avail: NTIS HC A09/MF A01

Several methods for determining the amount of snow which will, in due course, produce melt water runoff are reviewed. The conventional methods are generally based on direct field measurements of the snow pack in the spring or meteorological observations during the winter. Certain remote sensing techniques are also utilized to determine water equivalent of the snow. It is quite clear that satellite data can be used to study the snow cover, at least in areas of little vegetation, but there is no simple method which determines directly the snow depth or its water equivalent. Therefore, a more indirect method was developed, using the percent snow coverage as found in the spring to determine expected melt water runoff. The method is based on an empirical relation between the areal extent of remaining snow cover and runoff. Author (ESA)

N81-27587# Geological Survey, Washington, D. C.
REMOTE SENSING FOR FLOOD MAPPING AND FLOODPLAIN DAMAGE ASSESSMENT
Morris Deutsch *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 115-118 refs (For primary document see N81-27571 18-43)
Avail: NTIS HC A09/MF A01

Remote sensing in hydrology to observe and measure dynamic conditions of water quantity and quality is introduced. The 1972 investigation of damage caused by the disasterous flood of Rapid Creek at Rapid City, South Dakota, is cited as an example. A number of other floods of varying types in varying terrains that were examined in detail on aircraft or satellite imagery are mentioned. Modes of data collection, processing and interpretation are described. A basis for design of a national program for quick-response flood mapping for damage assessment is established. Author (ESA)

N81-27588# Freie Univ., Berlin (West Germany). Inst. fuer Geophysikalische Wissenschanften.
PREDICTION AND ASSESSMENT OF DISASTERS RELATED TO EARTH'S CRUST MOVEMENTS: EARTHQUAKES AND VOLCANISM
Andreas Vogel *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 119-124 refs (For primary document see N81-27571 18-43)
Avail: NTIS HC A09/MF A01

The predictability of earthquakes is discussed and earthquake prediction research is defined. Global tectonics and the nature of earthquakes are considered. Present interdisciplinary approaches to earthquake prediction are shown. Precursory ground deformation observation with space geodetic techniques is described. Regarding seismotectonic studies which are of special concern in earthquake risk analysis, it is shown that remote sensing is a useful tool to delineate active and hazardous faults. Application of remote sensing for volcanic hazard assessment is also treated. The importance of satellite data collection systems in earthquake and volcanic hazard assessment is underlined. Author (ESA)

N81-27589# Food and Agriculture Organization of the United Nations, Rome (Italy). Plant Protection Service.
APPLICATIONS OF REMOTE SENSING FOR MONITORING OF THE ENVIRONMENT IN ARID AREAS WITH PARTICULAR REFERENCE TO NATURAL VEGETATION FOR DESERT LOCUST SURVEILLANCE AND FORECASTING
Jelle U. Hielkema *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 125-152 refs (For primary document see N81-27571 18-43)
Avail: NTIS HC A09/MF A01

Satellite remote sensing techniques and methods for detection and monitoring of the ecological conditions of desert locust population development in its recession area were developed. The characteristics of the LANDSAT data feature space for arid areas and a technique for largely automated detection and monitoring of desert vegetation biomass relevant to locust development are given. Multitemporal LANDSAT data processing is specified, including a technique for data normalization to correct for atmospheric effects and a methodology for calculation of satellite determined potential breeding activity factors. Author (ESA)

N81-27590# Centre National d'Etudes Spatiales, Toulouse (France).
EXAMPLES OF METEOROLOGICAL SATELLITE DATA UTILIZATION [EXEMPLES D'UTILISATION DE DONNEES DE SATELLITE METEOROLOGIQUES]
J. C. Favard *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 153-171 refs In FRENCH (For primary document see N81-27571 18-43)
Avail: NTIS HC A09/MF A01

Different uses for satellite remote sensing are presented. Examples mainly concern METEOSAT, SMS, and GOES experience. Data applications include stereography, cloud cover analysis, thermal mapping, and ocean surface temperature sounding as an aid to the tuna fishing industry. Data collection techniques are explained, and results are highlighted in context. Author (ESA)

N81-27591# Food and Agriculture Organization of the United Nations, Rome (Italy).
PLANNING OF PROJECTS FOR TECHNICAL ASSISTANCE
A. Aydin *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 173-174 (For primary document see N81-27571 18-43)
Avail: NTIS HC A09/MF A01

A synthesis of FAO project planning methodology is presented. A need for change in an area or sector can lead to identification of a project. Analysis of the situation around that need helps in setting intermediate and immediate objectives and in the formulation of the project concerned, including built-in monitoring procedures to facilitate measuring the effect and impact of its implementation. Once the project is fully formulated it is documented following a given format which provides a framework to describe the basic elements and resource requirements. Author (ESA)

N81-27592# Coast Guard Research and Development Center, Groton, Conn.
BIBLIOGRAPHY OF ICE PROPERTIES AND FORECASTING RELATED TO TRANSPORTATION IN ICE-COVERED WATERS Final Report
Paul E. Greisman Sep. 1980 186 p refs
(AD-A099725; CGR/DC-9/80; USCG-D-25-81) Avail: NTIS HC A09/MF A01 CSCL 08/12

This bibliography is intended as a tool for those performing research in ice properties related to ships; particularly icebreaker, operations. The areas covered are the properties of lake, sea and river ice as they relate to mechanical behavior, remote sensing, and ice motions. Other topics included are: ice climatology, pressure ridges, shipping routes, vehicles and vessels, scientific

studies by the Arctic Ice Dynamics Joint Experiment (AIDJEX) and other bibliographies. Author (GRA)

N81-27593# Image Graphics, Inc., Fairfield, Conn.
A CARTOGRAPHIC ELECTRON BEAM SCANNER DESIGN STUDY Final Report
Patrick F. Grosso and Andrew A. Tarnowski Apr. 1981 48 p refs
(Contract DAAK70-79-C-0132)
(AD-A100035; Rept-6005; ETL-0257) Avail: NTIS HC A03/MF A01 CSCL 08/2

The feasibility of adding a scanning/readout capability to Cartographic Electron Beam Recorder System was successfully demonstrated. An electron beam scanning mode of operation would allow cartographic line and gray shade data recorded on film to be rapidly digitized using a high resolution scanning electron beam. Further engineering programs are recommended to develop this capability. Author (GRA)

N81-27594# Ohio State Univ., Columbus.
SOIL-LANDSCAPE RELATIONS AT SELECTED SITES ALONG ENVIRONMENTAL GRADIENTS IN NORTHERN ALASKA Final Report, 1 Aug. 1979 - 31 Jan. 1981
Kaye R. Everett Research Triangle Park, N. C. Army Research Office May 1981 380 p refs
(Contract DAAG29-79-C-0160; Grant DAAG29-76-G-0293)
(AD-A099583; ARO-14037.1-GS; ARO-16847.1-GS) Avail: NTIS HC A17/MF A01 CSCL 08/13

This report was prepared from data gathered between 1976 and 1980. The objectives are: (1) To trace the development of soils, especially those of the wet tundra, and their relationship to associated microtopography; (2) To determine to what extent the wet tundra soils and their related microtopography are the products of a cyclic repetition of events involving vegetation succession and hydrologic changes (tussock tundra) or, in the case of the very wet polygonized tundras, are the products of an evolutionary sequence leading to the abolition of the pattern and the creation of a new landform-soil association; (3) To determine the time frame in which these processes occur and thus gain an understanding of the temporal stability of the soils and landforms along the regional gradients and within selected mesogradients; and (4) To produce a detailed series of soil-landform maps and soil characterizations for selected areas along the gradients using the techniques developed for the coastal plain tundra. GRA

N81-27595# Sandia Labs., Albuquerque, N. Mex.
ENHANCED OIL RECOVERY BY THERMAL METHODS
H. M. Stoller 1981 15 p refs Presented at the 8th Energy Tech. Conf. and Exposition, Washington, D.C., 9 Mar. 1981
(Contract DE-AC04-76DP-00789)
(SAND-81-0444C; CONF-810315-2) Avail: NTIS HC A02/MF A01

A variety of opinions exist on the future of thermal oil recovery processes are explored, ranging from a pessimistic view that they are a diminishing factor because the best reservoirs for thermal floods have already been exploited to the optimistic based on the availability of resources, the gaining of experience, the increasing in prices and the development of new technologies. The US and the world have tremendous of heavy oil for which thermal methods may be the only recovery process. The need exists to develop this capability, and if successful, the impact on availability of hydrocarbons will be great. DOE

N81-27596# Environmental Monitoring and Support Lab., Las Vegas, Nev. Office of Research and Development.
REMOTE MONITORING OF ORGANIC CARBON IN SURFACE WATERS
Michael Bristow and David Nielsen Feb. 1981 93 p refs
(PB81-168965; EPA-600/4-81-001) Avail: NTIS HC A05/MF A01 CSCL 13B

The intensity of the Raman normalized fluorescence emission induced in surface waters by ultraviolet radiation can be used to provide a unique remote sensing capability for airborne monitoring the concentration of dissolved organic carbon (DOC). Trace concentrations of hydrocarbons, both manmade and natural in origin, are the predominant source for this fluorescence. Water, on the other hand, is nonfluorescent under UV irradiation, but emits an intense Raman band of constant amplitude relative to the incident light. This Raman emission can be used as an internal reference or normalizing standard with which to correct the fluorescence emission for the effects of attenuation, for variations in system sensitivity, and for changes in sensor elevation. It is suggested that a direct calibration of the airborne fluorescence data in terms of equivalent DOC concentration be accomplished by making DOC measurements on samples obtained at a small number of reference sites under the aircraft flight path at the time of the airborne survey. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N81-27597*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADDITIVE FOR ZINC ELECTRODES Patent Application
D. G. Soltis, D. W. Sheibley, and W. J. Nagle, inventors (to NASA) Filed 10 Jun. 1981 7 p
(NASA-Case-LEW-13286-1; US-Patent-Appl-SN-272406) Avail: NTIS HC A02/MF A01 CSCL 10C

An improved zinc electrode for alkaline cells includes up to about ten percent by weight of Ba(OH)2.8H2O with about five percent being preferred. The zinc electrode may or may not be amalgamated with mercury. NASA

N81-27598*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HEAT TRANSPARENT HIGH INTENSITY HIGH EFFICIENCY SOLAR CELL Patent Application
J. C. Evans, Jr., inventor (to NASA) Filed 15 May 1981 13 p
(NASA-Case-LEW-12892-1; US-Patent-Appl-SN-264380) Avail: NTIS HC A02/MF A01 CSCL 10A

A heat transparent high intensity solar cell with improved efficiency is described. The surface of each solar cell has a plurality of grooves. Each groove has a vertical face and a slanted face that is covered by a reflecting metal. Light rays are reflected from the slanted face through the vertical face where they traverse a photovoltaic junction. As the light rays travel to the slanted face of an adjacent groove, they again traverse the junction. The underside of the reflecting coating directs the light rays toward the opposite surface of solar cell as they traverse the junction again. When the light rays travel through the solar cell and reach the saw toothed grooves on the under side, the process of reflection and repeatedly traversing the junction again takes place. The light rays ultimately emerge from the solar cell. These solar cells are particularly useful at very high levels of insolation because the infrared or heat radiation passes through the cells without being appreciably absorbed to heat the cell. NASA

N81-27599*# National Aeronautics and Space Administration. Pasadena Office, Calif.
A STABLE DENSITY-STRATIFICATION SOLAR POND Patent Application
Fikry L. Lansing, inventor (to NASA) (JPL, California Inst. of Tech., Pasadena) Filed 30 Apr. 1981 15 p
(Contract NAS7-100)
(NASA-Case-NPO-15419-1; US-Patent-Appl-SN-259208) Avail: NTIS HC A02/MF A01 CSCL 10A

A solar pond for collecting and storing solar thermal energy includes a container having one section characterized by an internal wall of a substantially cylindrical configuration and a second section having an internal wall of a substantially truncated conical configuration surmounting and in coaxial alignment with the first section. The second section is characterized by a base of a diameter substantially equal to the diameter of the first section

and a truncated apex defining a solar energy acceptance opening. A body of immiscible liquids is disposed within the container and comprises a first portion substantially filling the first section of the container and a second portion substantially filling the second section of the container. The first portion is of a darker color than the second portion and of a greater density. A protective cover plant is removably provided for covering the acceptance opening. NASA

N81-27600*# National Aeronautics and Space Administration, Washington, D. C.
GROWIAN 2 FOR MORE WIND POWER AND FIRST EUROPEAN SOLAR FARM INAUGURATED
Oct. 1980 4 p Transl. into ENGLISH from Unschau in Wissenschaft uh Techn. (West Germany), v. 80, no. 15, 1980 p 475-477 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76177) Avail: NTIS HC A02/MF A01 CSCL 10B

A wind power installation with a power of five megawatts to be used in the Federal Republic of Germany is described. The first European solar farm was inaugurated in Madrid, and its operation is discussed. Author

N81-27601*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE 17TH PROJECT INTEGRATION MEETING Progress Report, Sep. 1980 - Feb. 1981
R. R. McDonald Feb. 1981 508 p refs Meeting held at Pasadena, Calif., 4-5 Feb. 1981
(Contract NAS7-100; Contract EX-76-A-29-1012)
(NASA-CR-164553; JPL-Pub-81-35; DOE/JPL-1012/54; PR-17) Avail: NTIS HC A22/MF A01 CSCL 10A

Progress made by the Low-Cost Solar Array Project during the period September 1980 to February 1981 is described. Included are reports on project analysis and integration; technology development in silicon material, large-area silicon sheet and encapsulation; production process and equipment development; engineering, and operations. A report on and copies of visual presentations made at the Project Integration Meeting held at Pasadena, California on February 4 and 5, 1981 are also included. Author

N81-27602*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE 1-kW SOLAR STIRLING EXPERIMENT Final Report
A. Giandomenico 15 May 1981 107 p refs
(Contract NAS7-100)
(NASA-CR-164530; JPL-Pub-81-38) Avail: NTIS HC A06/MF A01 CSCL 10A

The objective of this experiment was to demonstrate electrical power generation using a small free-piston Stirling engine and linear alternator in conjunction with a parabolic solar collector. A test bed collector, formerly used at the JPL Table Mountain Observatory, was renovated and used to obtain practical experience and to determine test receiver performance. The collector was mounted on a two-axis tracker, with a cold water calorimeter mounted on the collector to measure its efficiency, while a separate, independently tracking radiometer was used to measure solar insolation. The solar receiver was designed to absorb energy from the collector, then transfer the resulting thermal energy to the Stirling engine. Successful testing of receiver/collector assembly yielded valuable inputs for design of the Stirling engine heater head. Author

N81-27603*# Delaware Univ., Newark.
HEAT STORAGE IN ALLOY TRANSFORMATIONS Final Report
C. Ernest Birchenall, Selcuk I. Gueceri, Diana Farkas, Michael B. Labdon, Nikhil Nagaswami, and Bruce Pregger Mar. 1981 167 p refs
(Grant NsG-3184; Contract EC-77-A-31-1034)
(NASA-CR-165355; DOE/NASA/3184-2) Avail: NTIS HC A08/MF A01 CSCL 10C

The feasibility of using metal alloys as thermal energy storage media was determined. The following major elements were studied: (1) identification of congruently transforming alloys and thermochemical property measurements; (2) development of a precise and convenient method for measuring volume change during phase transformation and thermal expansion coefficients; (3) development of a numerical modeling routine for calculating heat flow in cylindrical heat exchangers containing phase change materials; and (4) identification of materials that could be used to contain the metal alloys. Several eutectic alloys and ternary intermetallic phases were determined. A method employing X-ray absorption techniques was developed to determine the coefficients of thermal expansion of both the solid and liquid phases and the volume change during phase transformation from data obtained during one continuous experimental test. The method and apparatus are discussed and the experimental results are presented. The development of the numerical modeling method is presented and results are discussed for both salt and metal alloy phase change media. E.A.K.

N81-27604*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPATIBILITY OF ALTERNATIVE FUELS WITH ADVANCED AUTOMOTIVE GAS TURBINE AND STIRLING ENGINES. A LITERATURE SURVEY Final Report
James Cairelli and David Horvath May 1981 44 p refs
(Contract DE-AI01-77CS-51040)
(NASA-TM-81754; DOE/NASA/51040-24; E-792) Avail: NTIS HC A03/MF A01 CSCL 10B

The application of alternative fuels in advanced automotive gas turbine and Stirling engines is discussed on the basis of a literature survey. These alternative engines are briefly described, and the aspects that will influence fuel selection are identified. Fuel properties and combustion properties are discussed, with consideration given to advanced materials and components. Alternative fuels from petroleum, coal, oil shale, alcohol, and hydrogen are discussed, and some background is given about the origin and production of these fuels. Fuel requirements for automotive gas turbine and Stirling engines are developed, and the need for certain reseach efforts is discussed. Future research efforts planned at Lewis are described. Author

N81-27605*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARATIVE RADIATION TESTING OF SOLAR CELLS FOR THE SHUTTLE POWER EXTENSION PACKAGE
Cosmo R. Baraona, Clifford K. Swartz, and Russell E. Hart, Jr. 1981 4 p refs Presented at the 15th Photovoltaic Spec. Conf., Kissimmee, Fla., 12-15 May 1982; sponsored by IEEE
(NASA-TM-82656; E-922) Avail: NTIS HC A02/MF A01 CSCL 10A

The Power Extension Package (PEP) is the prime focus of a development program to produce low cost solar cells. The PEP is a 32 kilowatt flexible substrate, retrievable, solar array system for use on the Space Shuttle. Solar cell cost will be reduced by increasing cell area and simplifying cell and coverglass fabrication processes and specifications. The cost goal is to produce cells below $30 per watt. Two and ten ohm-cm silicon cells were investigated. This paper describes a unique radiation damage test and side-by-side comparison of candidate cell types with pre-and post-irradiation airplane calibration of outer space short-circuit current. Author

N81-27606*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE MOD-2 WIND TURBINE DEVELOPMENT PROJECT Final Report
Bradford S. Linscott, Joann T. Dennett (RDD Consultants Inc.), and Larry H. Gordon Jul. 1981 24 p refs
(Contract DE-A101-79ET-20305)
(NASA-TM-82681; DOE/NASA/20305-5; E-965) Avail: NTIS HC A02/MF A01 CSCL 10B

A major phase of the Federal Wind Energy Program, the Mod-2 wind turbine, a second-generation machine developed by the Boeing Engineering and Construction Co. for the U.S. Department of Energy and the Lewis Research Center of the National Aeronautics and Space Administration, is described. The Mod-2 is a large (2.5-MW power rating) horizontal-axis wind turbine designed for the generation of electrical power on utility networks. Three machines were built and are located in a cluster at Goodnoe Hills, Washington. All technical aspects of the project

are described: design approach, significant innovation features, the mechanical system, the electrical power system, the control system, and the safety system. Author

N81-27607*# Westinghouse Research and Development Center, Pittsburgh, Pa.
LARGE AREA SHEET TASK: ADVANCED DENDRITIC WEB GROWTH DEVELOPMENT Quarterly Report, 1 Jan. - 31 Mar. 1981
C. S. Duncan, R. G. Seidensticker, J. P. McHugh, R. H. Hopkins, D. Meier, and J. Schruben 30 Apr. 1981 40 p refs
(Contract JPL-955842)
(NASA-CR-164623; DOE/JPL-955843-81/2; JPL-9950-557) Avail: NTIS HC A03/MF A01 CSCL 10A

A melt level control system was implemented to provide stepless silicon feed rates from zero to rates exactly matching the silicon consumed during web growth. Bench tests of the unit were successfully completed and the system mounted in a web furnace for operational verification. Tests of long term temperature drift correction techniques were made; web width monitoring seems most appropriate for feedback purposes. A system to program the initiation of the web growth cycle was successfully tested. A low cost temperature controller was tested which functions as well as units four times as expensive. E.D.K.

N81-27608*# Westinghouse Research and Development Center, Pittsburgh, Pa.
SILICON MATERIALS TASK OF THE LOW-COST SOLAR ARRAY PROJECT. PHASE 4: EFFECTS OF IMPURITIES AND PROCESSING ON SILICON SOLAR CELLS Quarterly Report, Jan. - Mar. 1981
R. H. Hopkins, M. H. Hanes, J. R. Davis, A. Rohatgi, P. Rai-Choudhury, and H. C. Mollenkopf (Hemlock Semiconductor Corp.) 29 Apr. 1981 68 p refs
(Contract JPL-954331)
(NASA-CR-164622; DOE/JPL-954331-81/14; JPL-9950-558; QR-22) Avail: NTIS HC A04/MF A01 CSCL 10A

The effects of impurities, various thermochemical processes, and any impurity-process interactions upon the performance of terrestrial solar cells are defined. The results form a basis for silicon producers, wafer manufacturers, and cell fabricators to develop appropriate cost benefit relationships for the use of less pure, less costly solar grade silicon. E.D.K.

N81-27609*# AIA Research Corp., Washington, D. C.
INTEGRATED RESIDENTIAL PHOTOVOLTAIC ARRAY DEVELOPMENT Quarterly Report
G. C. Royal, III 10 Apr. 1981 63 p refs Sponsored by NASA and DOE Prepared for JPL
(Contract JPL-955893)
(NASA-CR-164617; DOE/JPL-955893-81/1; JPL-9950-559; QR-1) Avail: NTIS HC A04/MF A01 CSCL 10A

Sixteen conceptual designs of residential photovoltaic arrays are described. Each design concept was evaluated by an industry advisory panel using a comprehensive set of technical, economic and institutional criteria. Key electrical and mechanical concerns that effect further array subsystem development are also discussed. Three integrated array design concepts were selected by the advisory panel for further optimization and development. From these concepts a single one will be selected for detailed analysis and prototype fabrication. The three concepts selected are: (1) An array of frameless panels/modules sealed in a T shaped zipper locking neoprene gasket grid pressure fitted into an extruded aluminum channel grid fastened across the rafters. (2) An array of frameless modules pressure fitted in a series of zipper locking EPDM rubber extrusions adhesively bonded to the roof. Series string voltage is developed using a set of integral tongue connectors and positioning blocks. (3) An array of frameless modules sealed by a silicone adhesive in a prefabricated grid of rigid tape and sheet metal attached to the roof. DOE

N81-27610*# Westinghouse Electric Corp., Pittsburgh, Pa.
LOW COST SOLAR ARRAY PROJECT PRODUCTION PROCESS AND EQUIPMENT TASK: A MODULE EXPERIMENTAL PROCESS SYSTEM DEVELOPMENT UNIT (MEPSDU) Quarterly Report, 1 Mar. - 31 May 1981
31 May 1981 44 p
(Contract JPL-955909)
(NASA-CR-164624; DOE/JPL-955909-81/2; JPL-9950-560; QR-2) Avail: NTIS HC A03/MF A01 CSCL 10A

Several major modifications were made to the design presented at the PDR. The frame was deleted in favor of a 'frameless' design which will provide a substantially improved cell packing factor. Potential shaded cell damage resulting from operation into a short circuit can be eliminated by a change in the cell series/parallel electrical interconnect configuration. The baseline process sequence defined for the MEPSON was refined and equipment design and specification work was completed. SAMICS cost analysis work accelerated, format A's were prepared and computer simulations completed. Design work on the automated cell interconnect station was focused on bond technique selection experiments. A.R.H.

N81-27611*# Optical Coating Lab., Inc., City of Industry, Calif. Photoelectronics Div.
SILICON SOLAR CELL PROCESS DEVELOPMENT, FABRICATION, AND ANALYSIS Quarterly Report, 1 Oct. - 31 Dec. 1980
H. I. Yoo, P. A. Iles, and D. C. Leung 31 Dec. 1980 54 p refs Sponsored by NASA Prepared for JPL
(Contract JPL-955089)
(NASA-CR-164618; DOE/JPL-955089-80/10; JPL-9950-561; QR-8) Avail: NTIS HC A04/MF A01 CSCL 10A

Solar cells from HEM, Dendritic Webs, and EFG ribbons were fabricated and characterized. The HEM solar cells showed only slight enhancement in cell performance after gettering steps (diffusion glass) were added. Dendritic webs from various growth runs indicated that performance of solar cells made from the webs was not as good as that of the conventional CZ cells. The EFG ribbons grown in CO ambient showed significant improvement in silicon quality. E.D.K.

N81-27612*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
LASER ANNEALING OF ION IMPLANTED CZ SILICON FOR SOLAR CELL JUNCTION FORMATION Final Report
J. S. Katzeff Jun. 1981 76 p refs
(Contract JPL-955696)
(NASA-CR-164625; DOE/JPL-955696-81/4; JPL-9950-562) Avail: NTIS HC A05/MF A01 CSCL 10A

The merits of large spot size pulsed laser annealing of phosphorus implanted, Czochralski grown silicon for function formation of solar cells are evaluated. The feasibility and requirements are also determined to scale-up a laser system to anneal 7.62 cm diameter wafers at a rate of one wafer/second. Results show that laser annealing yields active, defect-free, shallow junction devices. Functional cells with AM 1 conversion efficiencies up to 15.4% for 2 x 2 cm and 2 x 4 cm sizes were attained. For larger cells, 7.62 cm dia., conversion efficiencies ranged up to 14.5%. Experiments showed that texture etched surfaces are not compatible with pulsed laser annealing due to the surface melting caused by the laser energy. When compared with furnace annealed cells, the laser annealed cells generally exhibited conversion efficiencies which were equal to or better than those furnace annealed. In addition, laser annealing has greater throughput potential. M.G.

N81-27613*# Sonoscan, Inc., Bensenville, Ill.
EXAMINATION OF SILICON SOLAR CELLS BY MEANS OF THE SCANNING LASER ACOUSTIC MICROSCOPE (SLAM)
Carol Vorres and Donald E. Yuhas 28 Apr. 1981 66 p
(Contract JPL-955910)
(NASA-CR-164579; R-117; JPL-9950-564) Avail: NTIS HC A04/MF A01 CSCL 10A

The Scanning Laser Acoustic Microscope produces images of internal structure in materials. The acoustic microscope is an imaging system based upon acoustic rather than electromagnetic waves. Variations in the elastic propertis are primarily responsible for structure visualized in acoustic micrographs. The instrument used in these investigations is the SONOMICROSCOPE 100 which can be operated at ultrasonic frequencies of from 30 MHz to 500 MHz. The examination of the silicon solar cells was made at 100 MHz. Data are presented in the form of photomicrographs. E.D.K.

N81-27614*# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
INVESTIGATION OF THE HYDROGENATION OF SiCl4 Final Report, 31 Mar. 1979 - 1 Apr. 1981
Jeffrey Y. P. Mui and Dietmar Seyferth 15 Apr. 1981 123 p refs
(Contract JPL-955382)
(NASA-CR-164626; DOE/JPL-955382-79/8; JPL-9950-566) Avail: NTIS HC A06/MF A01 CSCL 10A

A laboratory scale pressure reactor was constructed to study the 3 SiCl + 2H2 + Si yields 4 SiHCl3 reaction at pressures up to 500 psig. Reaction kinetic measurements were carried out as a function of reactor pressure, reaction temperature and H2/SiCl4 feed ratio. Based on the reaction kinetic data, the hydroclorination of SiCl4 and m.g. silicon metal is found to be an efficient process to produce SiHCl3 in good conversions and in high yields. Copper is an effective catalyst. Results of the corrosion study show that conventional nickel chromium alloys are suitable material of construction for the hydrochlorination reactor. The hydrochlorination reaction is relatively insensitive to external process parameters such as silicon particle size distribution and the impurities in the m.g. silicon metal. A.R.H.

N81-27615*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POLYVINYL ALCOHOL BATTERY SEPARATOR CONTAINING INERT FILLER Patent Application
Dean W. Sheibley, Li-Chen Hsu, and Michelle A. Manzo, inventors (to NASA) Filed 10 Jun. 1981 14 p
(NASA-Case-LEW-13556-1; US-Patent-Appl-SN-272233) Avail: NTIS HC A02/MF A01 CSCL 10C

A cross-linked polyvinyl alcohol battery separator is disclosed. A particulate filler, inert to alkaline electrolyte of an alkaline battery, is incorporated in the separator in an amount of 1-20% by weight, based on the weight of the polyvinyl alcohol, and is dispersed throughout the product. Incorporation of the filler enhences performance and increases cycle life of alkaline batteries when compared with batteries containing a similar separator not containing filler. Suitable fillers include titanates, silicates, zirconates, aluminates, wood floor, lignin, and titania. Particle size is not greater than about 50 microns. NASA

N81-27616*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF FORMING OXIDE COATINGS Patent Application
G. E. McDonald, inventor (to NASA) Filed 10 Jun. 1981 7 p
(NASA-Case-Lew-13132-1; US-Patent-Appl-SN-272152) Avail: NTIS HC A02/MF A01 CSCL 10A

This invention is concerned with an improved plating process for covering a substrate with a black metal oxide film. The invention is particularly directed to making a heating panel for a solar collector. A compound is electrodeposited from an aqueous solution containing cobalt metal salts onto a metal substrate. This compound is converted during plating into a black, highly absorbing oxide coating which contains hydrated oxides. This is achieved by the inclusion of an oxidizing agent in the plating bath. The inclusion of an oxidizing agent in the plating bath is contrary to standard electroplating practice. The hydrated oxides are converted to oxides by treatment in a hot bath, such as boiling water. An oxidizing agent may be added to the hot liquid treating bath. NASA

N81-27617*# National Aeronautics and Space Administration, Washington, D. C.
USE OF REVERSIBLE HYDRIDES FOR HYDROGEN STORAGE
B. Darriet, M. Pezat, and P. Hagenmuller Dec. 1980 18 p refs Transl. into ENGLISH from Proceedings of the 1st Seminar on Hydrogen as an Energy Vector: Its Production, Use and Transportation (Belgium), 1978 p 393-406 Conf. held in Brussels, 3-4 Oct. 1978; sponsored by the Luxembourg Commission of the European Communities Original language document was announced as A80-15991 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75723) Avail: NTIS HC A02/MF A01 CSCL 10C

The addition of metals or alloys whose hydrides have a high dissociation pressure allows a considerable increase in the hydrogenation rate of magnesium. The influence of temperature and hydrogen pressure on the reaction rate were studied. Results concerning the hydriding of magnesium rich alloys such as Mg2Ca, La2Mg17 and CeMg12 are presented. The hydriding mechanism of La2Mg17 and CeMg12 alloys is given. Author

N81-27618*# Naval Weapons Support Center, Crane, Ind.
CYCLE LIFE TEST OF SECONDARY SPACECRAFT CELLS Annual Report
J. D. Harkness 4 Apr. 1980 293 p refs
(NASA Order C-13105-D)
(NASA-CR-166686; WQEC/C-80-34; AR-16) Avail: NTIS HC A13/MF A01 CSCL 10C

The results of the life cycling program on rechargeable calls are reported. Information on required data, the use of which the data will be put, application details, including orbital description, charge control methods, load rquirements, etc., are given. Cycle tests were performed on 660 sealed, nickel cadmium cells. The cells consisted of seven sample classifications ranging form 3.0 to 20 amp. hours. Nickel cadmium, silver cadmium, and silver zinc sealed cells, excluding synchronous orbit and accelerated test packs were added. The capacities of the nickel cadmium cells, the silver cadmium and the silver zinc cells differed in range of amp hrs. The cells were cylced under different load, charge control, and temperature conditions. All cell packs are recharged by use of a pack voltage limit. All charging is constant current until the voltage limit is reached. E.A.K.

N81-27619*# Rocketdyne, Canoga Park, Calif.
HIGH-PRESSURE LOX/HYDROCARBON PREBURNERS AND GAS GENERATORS Final Report, Dec. 1978 - Apr. 1981
A. W. Huebner Apr. 1981 192 p refs
(Contract NAS8-33243)
(NASA-CR-161814; RI/RD81-129) Avail: NTIS HC A09/MF A01 CSCL 10B

The objective of the program was to conduct a small scale hardware test program to establish the technology base required for LOX/hydrocarbon preburners and gas generators. The program consisted of six major tasks; Task I reviewed and assessed the performance prediction models and defined a subscale test program. Task II designed and fabricated this subscale hardware. Task III tested and analyzed the data from this hardware. Task IV analyzed the hot fire results and formulated a preliminary design for 40K preburner assemblies. Task V took the preliminary design and detailed and fabricated three 40K size preburner assemblies, one each fuel-rich LOX/CH, and LOX/RP-1 and one oxidizer rich LOX/CH4. Task VI delivered these preburner assemblies to MSFC for subsequent evaluation. Author

N81-27620*# Honeywell Systems and Research Center, Minneapolis, Minn.
SPECTROPHOTOVOLTAIC ORBITAL POWER GENERATION, PHASE 2 Final Report, Aug. 1980 - Mar. 1981
Sau Kwan Lo, David Stoltzman, Gary Knowles, and Ray Lin 1 Apr. 1981 107 p refs
(Contract NAS8-33511)
(NASA-CR-161813; HONEYWELL-81SRC35) Avail: NTIS HC A06/MF A01 CSCL 10A

A subscale model of the spectral splitting concentrator system with 10' aperture is defined and designed. The model is basically a scaled down version of Phase 1 design with an effective concentration ratio up to 1000:1. The system performance is predicted to be 21.5% for the 2 cell GaAs/Si system, and 20% for Si/GaAs at AM2 using realistic component efficiencies. Component cost of the model is projected in the $50K range. Component and system test plans are also detailed. Author

N81-27621# Committee on Government Operations (U. S. House).
DEPARTMENT OF ENERGY'S EMERGENCY CONSERVATION PROGRAMS
Washington GPO 1980 203 p refs Hearing before a Subcomm. of the Comm. on Govt. Operations, 96th Congr., 2nd Sess., 4 Sep. 1980
(GPO-69-251) Avail: Committee on Government Operations

The hearings focused on the Emergency Energy Conservation Act of 1979. The act provides for a procedure to develop a rationing plan. Conservation plans flexible enough to meet the needs of various State needs and practical enough to be rapidly implemented to meet national targets are discussed. T.M.

N81-27622*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SATELLITE POWER SYSTEM: CONCEPT DEVELOPMENT AND EVALUATION PROGRAM. VOLUME 3: POWER TRANSMISSION AND RECEPTION. TECHNICAL SUMMARY AND ASSESSMENT
R. H. Dietz, G. D. Arndt, J. W. Seyl, L. Leopold, and J. S. Kelley Jul. 1981 280 p refs
(NASA-RP-1076; S-507) Avail: NTIS HC A13/MF A01 CSCL 10A

Efforts in the DOE/NASA concept development and evaluation program are discussed for the solar power satellite power transmission and reception system. A technical summary is provided together with a summary of system assessment activities. System options and system definition drivers are described. Major system assessment activities were in support of the reference system definition, solid state system studies, critical technology supporting investigations, and various system and subsystem tradeoffs. These activities are described together with reference system updates and alternative concepts for each of the subsystem areas. Conclusions reached as a result of the numerous analytical and experimental evaluations are presented. Remaining issues for a possible follow-on program are identified. A.R.H.

N81-27623# Energy Research Corp., Danbury, Conn.
AQUEOUS TRIFLUOROMETHANESULFONIC ACID FUEL CELLS Final Technical Progress Report, Jun. 1978 - Oct. 1980
Michael George Feb. 1981 61 p refs
(Contract DAAK70-78-C-0103)
(AD-A098919; ERC-6154-F) Avail: NTIS HC A04/MF A01 CSCL 10/2

Hydrogen-air fuel cells were successfully operated with 6M TFMSA as the electrolyte at temperatures as high as 90 C. The fuel cell performance was enhanced over similarly loaded electrodes in H3PO4 due to the apparent improved kinetics for the oxygen reduction reaction. A variety of unsupported and supported Pt electrocatalysts could be effectively utilized. Subscale TFMSA fuel cells could be operated stably for periods as long as 3000 hours. Evaluation of TFMSA electrolytes in stack configurations was encouraging as acceptable initial performance levels were demonstrated. Author (GRA)

N81-27624# UOP, Inc., Des Plaines, Ill.
DEVELOPMENT OF ADVANCED KOCITE ELECTROCATALYSTS FOR PHOSPHORIC ACID FUEL CELLS Final Technical Report, Sep. 1979 - Dec. 1980
L. S. Welsh, R. W. Leyerle, D. S. Scarlata, and M. A. Vanek Jan. 1981 50 p refs
(Contract DAAK70-79-C-0173; DA Proj. 1L1-61102-AH-51)
(AD-A099910) Avail: NTIS HC A03/MF A01 CSCL 10/2

These improved electrocatalysts should demonstrate a larger initial catalytic metal surface area, and a better catalytic metal surface area retention during fuel cell operation than present state-of-the-art phosphoric acid electrocatalysts. Kocite electrocatalysts impregnated with platinum and platinum-vanadium alloys were tested. The Kocite electrocatalysts were aged in electrodes potentiostated in H3PO4 half cells, and were then analyzed for catalytic metals surface area retention. Compared with the state-of-the-art platinum electrocatalysts, as represented by a standard Kocite electrocatalyst, the Kocite electrocatalysts impregnated by the techniques used in this study have a better initial platinum surface area. This initial surface area difference appeared to be maintained when the catalysts are aged at 700 mV, but was not maintained when the catalysts were aged at 800 mV. Variations of the alumina substrate and of the post-treatment of the leached Kocite catalyst support did not produce any catalysts with better platinum surface area retention than the standard catalyst. Alloying of vanadium with the platinum did produce Kocite electrocatalysts which maintained their alloy surface area better than the standard catalyst maintained its platinum surface area. Author (GRA)

N81-27625# Systech Corp., Xenia, Ohio.
TEST AND EVALUATION OF THE HEAT RECOVERY INCINERATOR SYSTEM AT NAVAL STATION, MAYPORT, FLORIDA Final Report, Jun. 1980 - Apr. 1981
May 1981 169 p
(Contract N68305-80-C-0006)
(AD-A099559; CEL-CR-81.012) Avail: NTIS HC A08/MF A01 CSCL 13/2

This report describes test and evaluation of the two-ton/hr heat recovery incinerator (HRI) facility located at Mayport Naval Station, Fla., carried out during November and December 1980. The tests included: (1) Solid Waste: characterization, heating value, and ultimate analysis, (2) Ash: moisture, combustibles, and heating values of both bottom and cyclone ashes; Extraction Procedure toxicity tests on leachates from both bottom and cyclone ashes; trace metals in cyclone particulates, (3) Stack Emissions: particulates (quantity and size distribution), chlorides, oxygen, carbon dioxide, carbon monoxide, and trace elements, and (4) Heat and Mass Balance: all measurements required to carry out complete heat and mass balance calculations over the test period. The overall thermal efficiency of the HRI facility while operating at approximately 1.0 ton/hr was found to be 49% when the primary Btu equivalent of the electrical energy consumed during the test program was included. GRA

N81-27626# California Univ., Fullerton.
SOLAR ENERGY STORAGE PROJECTS Final Report
John Olmsted, III, Donald E. Garrett (Garrett Energy Research and Engineering Co.), Marvin L. Stary (Stary (Marvin L.), Claremont, Calif.), Jurg Bieri (Heliodyne, Inc.), and Fritz Haas (North Bay Research) Sep. 1980 118 p refs
(Contracts FG03-78SF-01964; FG03-78SF-01929; FG03-78ET-10734; FG03-78ET-20208; Grants EM-78-G-03-19642; EM-78-G-03-01929; EM-78-G-03-1991; EM-78-G-03-1930)
(DOE/SF-01964/T1; DOE/SF-01929/T1; DOE/ET-10734/T1; DOE/ET-20208/T1) Avail: NTIS HC A06/MF A01

Four reports are included on idea and hardware development of photochemical, glauber salt, stratifiable liquid thermal, and modular concrete block energy storage strategies. Separate abstracts are prepared for three. DOE

N81-27627# AIA Research Corp., Washington, D. C.
PASSIVE SOLAR DESIGN: FINAL EVALUATION, THE PASSIVE STUDIO
Aug. 1980 9 p refs
(Contract DE-AC02-79CS-30120)
(DOE/CS-30120/1) Avail: NTIS HC A02/MF A01

The further evaluation of the workshops in passive design for practicing architects and engineers through delayed interviews with a sample of the participants is reported with particular emphasis on the extent to which the participants have practiced passive design in the three to four months since attending. Also discussed is an unsuccessful attempt to conduct a lower cost version of the program outside of normal office hours. Finally, the follow-on programs and improvements that the interviews indicated are needed are identified. DOE

N81-27628# Oak Ridge National Lab., Tenn. Energy Div.
REVIEW OF EVALUATIONS OF UTILITY HOME-ENERGY-AUDIT PROGRAMS
L. Berry, Jon Soderstrom, Erich Hirst, Bobbie Newman, and Rose Weaver Mar. 1981 78 p refs
(Contract W-7405-eng-26)
(ORNL/CON-58) Avail: NTIS HC A05/MF A01

Evaluation efforts of utilities with active home energy audit programs are reviewed to suggest methodologies, issues, and data that can contribute to the development of a comprehensive Residential Conservation Service evaluation plan. On the basis mainly of written reports received from the utilities, findings about customer response to programs are summarized. The topics discussed include: correlates of program penetration rates; use of financing; attitudes toward programs; actions taken; characteristics of participants; and energy savings due to programs. Particular attention is given to three studies (Tennessee Valley Authority, Seattle City Light, and Pacific Gas and Electric) that analyze fuel consumption records as part of the evaluation. DOE

N81-27629# Oak Ridge National Lab., Tenn. Energy Div.
DISTRICT HEATING/COGENERATION APPLICATION STUDIES FOR THE MINNEAPOLIS-ST. PAUL AREA. IMPACT OF A DISTRICT HEATING/COGENERATION SYSTEM ON ANNUAL AVERAGE SO2 AIR QUALITY IN THE TWIN CITIES
M. A. Karnitz, F. C. Kornegay, H. A. McLain, B. D. Murphy, R. J. Raridon, and E. C. Shlatter Mar. 1981 109 p refs
(Contract W-7405-eng-26)
(ORNL-TM-6830/P11) Avail: NTIS HC A06/MF A01

Annual average SO2 concentrations in air at ground level were determined for a base year (1976) and for a future year (1987) with and without a 2600-MW(t) district heating system. Without district heating, the SO2 concentrations in the area are predicted to increase with time because of anticipated increased substitution of oil for curtailed natural gas. Implementation of the district heating/cogeneration system is predicted to mitigate this increase of SO2 concentrations significantly. Although the total emissions will be slightly higher with district heating/cogeneration because of the substitution of coal for natural gas and oil, use of tall stacks at the cogeneration plants will permit greater dispersion of the SO2 emissions. Considerable overall energy savings, particularly in the form of natural gas and oil, will be realized with a district heating/cogeneration system. DOE

N81-27630# Oak Ridge National Lab., Tenn.
DESIGN OF THE ATMOSPHERIC FLUIDIZED-BED COAL COMBUSTOR FOR COGENERATION GAS-TURBINE SYSTEM
R. S. Holcomb, P. A. Berman, and R. L. Gorrell 1981 10 p refs Presented at the ASME Gas Turbine Conf., Houston, Tex., 9 Mar. 1981 Prepared in cooperation with Westinghouse Electric Corp., Concordville, Penna. and Babcock and Wilcox Co., Barberton, Ohio
(CONF-810309-9) Avail: NTIS HC A02/MF A01

The development of the technology to provide a source of high temperature air for power generation for process heating in industrial plants. The program is directed toward systems in the size range of 5 to 50 MW(e). The major effort in the program is the design of a generic reference plant cogeneration system and the design and construction of a test system that will incorporate the salient features of the reference plant. DOE

N81-27631# Midwest Research Inst., Golden, Colo.
ANALYSIS OF HYBRID SOLAR SYSTEMS
J. Swisher Oct. 1980 6 p refs Presented at the AS of ISES Passive Solar Conf., Amherst, Mass., 19-25 Oct. 1980
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TP-721-825; CONF-801016-19) Avail: NTIS HC A02/MF A01

The TRNSYS simulation program was used to evaluate the performance of active charge/passive discharge solar systems with water as the working fluid. TRNSYS simulations are used to evaluate the heating performance and cooling augmentation provided by systems in several climates. The results of the simulations are used to develop a simplified analysis tool similar to the F-chart and Phi-bar procedures used for active systems. This tool, currently in a preliminary stage, should provide the designer with quantitative performance estimates for comparison with other passive, active, and nonsolar heating and cooling designs. DOE

N81-27632# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
VALUE ANALYSIS OF WIND ENERGY SYSTEMS TO ELECTRIC UTILITIES
D. Percival and Jim Harper Jan. 1981 9 p refs Presented at the ASME Solar Energy Div., 3rd Systems Simulation Econ. Anal./Solar Heating and Cooling Operational Results Conf., Reno, Nev., 27 Apr. - 1 May 1981
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TP-732-1064) Avail: NTIS HC A02/MF A01

The analysis is performed by a package of computer models that interface with most conventional utility planning models. Weather data are converted to wind turbine output powers, which are used to modify the utility load representation. Execution of the utility planning models with both the original and modified load representation yields the gross and marginal value ($/rated kW) of the added wind energy systems. This value is then compared with cost estimates to determine if for economic reasons the wind energy system should be included in future generation plans. DOE

N81-27633# MCC Associates, Inc., Silver Spring, Md.
PROCEEDINGS OF MECHANICAL MAGNETIC AND UNDERGROUND ENERGY STORAGE: 1980 Annual Contractor's Review
1980 469 p refs Proceedings held at Washington, D.C., 10-13 Nov. 1980 Prepared in cooperation with Battelle Pacific Northwest Labs.
(Contract DE-AC06-76RL-01830)
(CONF-801128) Avail: NTIS HC A20/MF A01

Technologies in the development of renewable energy systems, such as solar and wind energy, are reviewed. Reliable, efficient and econonomic energy storage technologies are analyzed. The following topics are discussed: seasonal thermal energy storage; compressed air energy storage; magnetic energy storage; flywheel energy storage. E.A.K.

N81-27634# Oak Ridge National Lab., Tenn. Engineering Physics Div.
APPROACH TO EVALUATING ENERGY-ECONOMY MODELS
C. R. Weisbin, R. W. Peele, and A. S. Leobl Mar. 1981 76 p refs
(Contract W-7405-eng-26)
(ORNL-5742) Avail: NTIS HC A05/MF A01

A set of guidelines was developed for evaluating energy economy models; the components of a thorough model evaluation are defined in an operational manner. Quantitative measures based on sensitivity and uncertainty analysis of results important to the user are included. Possible paths for future development of evaluation techniques are indicated, particularly those for which evaluation components must be more strictly defined after further practical experience is gained. DOE

N81-27635# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
ANALYSIS OF THE APPLICATION OF THERMOGALVANIC CELLS TO THE CONVERSION OF LOW GRADE HEAT TO ELECTRICITY
H. L. Chum, R. F. Fahlsing, and T. S. Jayadev Aug. 1980 8 p refs Presented at the 15th Intersoc. Energy Conversion Eng. Conf., Seattle, 18-22 1980
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TP-641-849; CONF-800806-41) Avail: NTIS HC A02/MF A01

Measurements on the copper/copper formate/copper system yield thermoelectric powers which are higher than those exhibited by other copper systems. In these solutions three copper formate complexes are present. Practical cells were built and tested. The power output is largely limited by cell resistance, though mass and charge transfer contribute to the observed overvoltages. The coupling of this thermogalvanic system with an electrochemical photovoltaic effect (a photothermogalvanic cell) is briefly described. DOE

N81-27636# Hagler, Bailly and Co., Washington, D.C.
ENERGY CONSUMPTION IN COMMERCIAL BUILDINGS: A COMPARISON WITH BEPS BUDGETS
22 Sep. 1980 58 p
(Contract DE-AC01-79CS-20184)
(DOE/CS-20184/T1) Avail: NTIS HC A04/MF A01

Metered energy consumption data were collected on existing commercial buildings to help establish the proposed building energy performance standards (BEPS). The search has identified 84 buildings whose metered energy consumption is equal to or less than that proposed for their BEPS budgets and another 7 buildings whose metered consumption is less than 20 percent above their BEPS budgets. The methodology used to identify the buildings and to collect their metered energy consumption data are described. The data are analyzed and summarized and conclusions are drawn. DOE

N81-27637# Metallgesellschaft, A.G., Frankfurt am Main (West Germany). Metall-Lab.

DEVELOPMENT OF COMPONENTS FOR THE SOLAR HEATING CIRCUIT Final Report
M. Moeller Dec. 1980 84 p refs In GERMAN; ENGLISH summary
(BMFT-FB-T-80-154) Avail: NTIS (U.S. Sales Only) HC A05/MF A01 DOE Depository Libraries

An aluminium-manganese-zirconium alloy suitable for the Roll-Bond method was developed and a process for the manufacture of solar absorbers on the basis of this material elaborated. Correctly adjusted, inhibited glycol-water mixtures and synthetic heat transfer fluids proved their value for solar installations with Al-components. Inhibited glycol-water mixtures should be regularly controlled as to their pH-value and the efficiency of the inhibitors. If synthetic heat transfer fluids are used, care should be taken that these and the installation are free from water to avoid corrosion damages. Solar installations with stagnation temperatures of up to 130 C should be operated with gylcol-water mixtures, whereas installations with higher stagnation temperatures are preferably run with synthetic heat transfer fluids. DOE

N81-27638# Tudor Engineering Co., San Francisco, Calif.
SIMPLIFIED METHODOLOGY FOR ECONOMIC SCREENING OF POTENTIAL LOW-HEAD SMALL-CAPACITY HYDROELECTRIC SITES Final Report, May 1979 - Aug. 1980
H. M. Brown Jan. 1981 229 p refs
(EPRI-EM-1679) Avail: NTIS HC A11/MF A01

A simplified methodology for economics screening of potential low-head, small capacity sites is presented in the form of a manual which permits a first level analysis to be made of a potential hydroelectric power site. Step-by-step procedures are described to assist personnel with a limited technical background to estimate the power and energy output and the project cost for a potential site, and to perform a preliminary economic analysis. Two procedures are described, one rapid and simplified and the other more detailed to provide for the variability inherent in hydroelectric site development. Background description are provided to assist those unfamiliar with hydroelectric practice. The manual covers plant capacities ranging from 200 to 15,000 kilowatts and a head range of 6 to 200 feet. DOE

N81-27639# Midwest Research Inst., Golden, Colo.
BIOTECHNOLOGICAL RESEARCH AND DEVELOPMENT FOR BIOMASS CONVERSION TO CHEMICALS AND FUELS
R. Villet Aug. 1980 22 p refs Presented at the Soc. for Ind. Microbiol. Ann. Meeting, Flagstaff, Ariz., 10 Aug. 1980
(Contract DE-AC02-77CH-00178)
(SERI/TP-621-954; CONF-800892-1) Avail: NTIS HC A02/MF A01

Revitalization of the older fermentation industry and development of biotechnology largely based on lignocellulose are proposed. Specific research projects are outlined in these two areas and also for the following: microbial formation of hydrocarbons; methane from anaerobic digestion; lignin; methanol. For cellulose conversion to ethanol the relative merits using added cellulases or, alternatively, direct fermentation with anaerobic thermophiles, are discussed. In selecting suitable feedstocks for biotechnological processes there is a need to use a production extraction conversion system as a basis for evaluation. DOE

N81-27640# Gas-Cooled Reactor Associates, La Jolla, Calif.
HIGH-TEMPERATURE GAS-COOLED REACTOR STEAM CYCLE/COGENERATION APPLICATION STUDY
Dec. 1980 336 p refs
(Contract DE-AC03-78SF-02034)
(DOE/SF-02034/T12) Avail: NTIS HC A15/MF A01

The evaluation of the HTGR-SC/C technology, the evaluation of potential HTGR-SC/C markets, the assessment of the economics of commercial HTGR-SC/C plants, and the evaluation of the program and expenditures necessary to establish HTGR-SC/C technology through the completion of the lead Project are presented. Further, the value of the HTGR-SC/C Lead Project in the support of advanced applications such as the HTGR-R is also addressed. The HTGR-SC/C is considered as a Lead project candidate in two configurations: a 2240-MW(t) baseload electric plant and an 1170-MW(t) cogeneration plant that provides electricity and process steam. DOE

N81-27641# Energy Research Corp., Danbury, Conn.
EVALUATION OF DISTRIBUTED GAS COOLING OF PRESSURIZED PAFC FOR UTILITY POWER GENERATION Technical Progress Report, Aug. - Nov. 1980
J. Ahmad, M. Farooque, M. Hooper, and H. Maru 1980 27 p
(Contract DE-AC01-78ET-13114)
(DOE/ET-13114/T6; TPR-4) Avail: NTIS HC A03/MF A01

A proof-of-concept test of a gas cooled pressurized phosphoric acid fuel cell (PAFC) is provided. Significant progress includes: design of subsystem components for the recirculation loop; fluid dynamic analyses of DIGAS cooling; and seal effectiveness testing of the baseline stack. DOE

N81-27642# Acres American, Inc., Buffalo, N. Y.
PROJECT DESIGN CRITERIA MANUAL: UPPER MECHANICVILLE HYDROELECTRIC REDEVELOPMENT PROJECT
Dec. 1980 101 p refs
(Contract DE-FC07-80ED-12117)
(DOE/RA-12117) Avail: NTIS HC A06/MF A01

The design criteria presented in this manual are to be used as the basis for the detailed design for the Upper Mechanicville, NY hydroelectric redevelopment project. The manual refers to codes and standards which are to be used in the design of the project. Design approaches not covered by existing codes and standards are also given for all phases of the project. The manual is divided into six sections: civil design, hydraulic design, geotechnical design, electrical systems, mechanical systems and major equipment. These design criteria are to be used as a guide for design. When changes become necessary, these shall be documented by the engineer responsible for the design. This documentation shall be sent to the project engineer and project manager for submission to the client for reference. The documentation shall specify the reason for the change and shall be routed to all Department Coordinators. DOE

N81-27643# Exxon Enterprises, Burlington, Mass. Solar Thermal Systems Div.
PERFORMANCE OF A SOLAR-HEATING MODULE FOR COMMERCIAL-GREENHOUSE USE, PHASE 5 Final Report
John M. Buchanan Jan. 1981 40 p refs
(Contracts DE-AC05-77CS-35299; EG-77-C-05-5299)
(DOE/CS-35299/T2) Avail: NTIS HC A03/MF A01

A large solar heat collector was constructed to assist the heat loads of a greenhouse. The collector is an insulated, black cavity with forced air circulating to transfer the solar energy to water storage via air to water heat exchangers. Performance records indicate that the annual collection is 20 percent of the solar radiation received, and lower than the 50 percent originally estimated. The years required before positive cash flow is established is increased from 10 to 25 years for a typical projection study. Recommendations are made for improving the solar collection module which, currently, has a performance that does not recommend its cavity-type design. DOE

N81-27644# Galaxy, Inc., Washington, D.C.
STUDIES ON ADVANCED OVERSEAS ENERGY TECHNOLOGIES, VOLUME 1 Final Report
R. W. Straus and J. N. Carsey Mar. 1981 124 p refs
(Contract DE-AC03-79SF-10538)
(DOE/SF-10538/T8-Vol-1) Avail: NTIS HC A06/MF A01

A final evaluation is presented covering investigations over the past 5 years to perceive energy conversion technology and covering over 100 advanced energy technologies which saw many new developments in energy conversion in the countries studied. Specifically, the state-of-the-art for specified technologies and the development of energy technologies overseas are discussed. The development of combustion technology in Sweden, Denmark, Finland, France, Netherlands, Italy, Spain, Portugal, Japan, Norway, and the Federal Republic of Germany is summarized. DOE

N81-27645# Idaho Nuclear Corp., Idaho Falls.
HYDROPOWER COMPUTERIZED RECONNAISSANCE PACKAGE, VERSION 2.0
C. R. Broadus Apr. 1981 131 p refs
(Contract DE-AC07-76ID-01570)
(DOE/ID-01570/T18) Avail: NTIS HC A07/MF A01

The package is a computerized preliminary engineering and economic study package for small hydroelectric projects which consists of three programs. One engineering program evaluates the flow characteristics of a site and determines the energy generated for various turbine configurations and two economic programs provide two levels of economic studies depending upon the amount of site-specific information available. An Apple II computer is utilized to provide a quick-turnaround capability. The models and methods used in the HCR package are described and information is provided on program application, sample run sessions, program outputs, and listings of the main programs. DOE

N81-27646# Puerto Rico Univ., Mayaguez.
DEVELOPMENT AND ANALYSIS OF A LINEARLY SEGMENTED CPC COLLECTOR FOR INDUSTRIAL STEAM GENERATION M.S. Thesis
Jose Alberto Atienza Figueroa Figueroa Jun. 1980 170 p refs
(Contract DE-AC05-76OR-00033)
(DOE/ER-00033/T4) Avail: NTIS HC A08/MF A01

The mirror consists of long and narrow planar segments placed inside sealed low-cost glass tubes. The absorber is a cylindrical fin inside an evacuated glass tube. The optical efficiency of the segmented concentrator was simulated by means of Monte-Carlo Ray-Tracing program. Laser Ray-Tracing techniques were also used to evaluate the possibilities of this new concept. A preliminary evaluation of the experimental concentrator was done using a relatively simple method that combines results from two experimental measurements: overall heat loss coefficient and optical efficienty. A transient behavior test was used to measure to overall heat loss coefficient throughout a wide range of temperature. DOE

N81-27647# Dynamics Technology, Inc., Torrance, Calif.
TECHNICAL ASSESSMENT OF AN AEROELECTRIC SOLAR POWER CONCEPT
E. C. James Feb. 1981 113 p refs
(Contract DE-AC01-80ER-10192)
(DOE/ER-10192/T1) Avail: NTIS HC A06/MF A01

The evaluation was based on a one dimensional flow analysis which invokes the conservation of mass, momentum and energy of the fluid mixture (air, water vapor and water droplets) flowing through the powerplant. A performance evaluation computer code was developed which can be used to assess the concept under diverse conditions of the powerplant was specified. Aerodynamic flow losses were using a compendium of pipe flow data for each component of the power plant. These losses are utilized in the flow analysis. Flow losses were estimated to be approximately one third of the stream's dynamic pressure in the tower's cylinder section. Geometric or configuration changes can be made to reduce aerodynamic loss. DOE

N81-27648# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
SOLAR HEATING AND COOLING OF RESIDENTIAL BUILDINGS: DESIGN OF SYSTEMS, 1980 EDITION
Sep. 1980 577 p Prepared in cooperation with Dept. of Commerce
(Contract DE-AC02-79CS-30062)
(DOE/CS-30062/T1) Avail: NTIS HC A25/MF A01

This manual was prepared primarily for use in conducting a practical training course on the design of solar heating and cooling systems for residential and small office buildings, but may also be useful as a general reference text. The content level is appropriate for persons with different and varied backgrounds, although it is assumed that readers possess a basic understanding of heating, ventilating, and air conditioning systems of conventional (non-solar) types. The manual was reorganized, new material was added, and outdated information was deleted. Only active solar systems are described. Liquid and air heating solar systems for combined space and service water heating or service water heating are included. Only systems with proven experience are discussed. DOE

N81-27649# State Univ. of New York, Buffalo. Lab. for Power and Environmental Studies.
NEW APPROACHES FOR THE REDUCTION OF PLASMA ARC DROP IN SECOND-GENERATION THERMIONIC CONVERTERS Final Report
M. E. Hatziprokopiou and D. T. Shaw 31 Mar. 1981 108 p refs
(Contract DE-AC02-79ET-15421)
(DOE/ET-15421/1) Avail: NTIS HC A06/MF A01

Investigations of ion generation and recombination mechanisms in the cesium plasma are described with respect to the advanced mode thermionic energy converter. The changes in plasma density and temperature within the converter were studied under the influence of several promising auxiliary ionization candidate sources. Three novel approaches of external cesium ion generation were studied in some detail, namely vibrationally excited N2 as an energy source of ionization of Cs ions in a dc discharge, microwave power as a means of resonant sustenance of the cesium plasma, and ion generation in a pulse N2-Cs mixture. The data obtained show that all three techniques - i.e., the non-LTE high voltage pulsing, the energy transfer from vibrationally excited diatomic gases, and the external pumping with a microwave power have considerable promise as schemes in auxiliary ion generation applicable to the advanced thermionic energy converter. DOE

N81-27650# Sandia Labs., Albuquerque, N. Mex.
GEOTHERMAL STUDIES AT KIRTLAND AIR FORCE BASE, ALBUQUERQUE, NEW MEXICO
Linda Riddle and Bob Grant May 1981 47 p refs
(Contract DE-AC04-76DP-00789)
(SAND-81-0852) Avail: NTIS HC A03/MF A01

New Mexico has geologic characteristics favorble for geothermal energy utilization. Local heat flow and geochemical studies indicate a normal subsurface temperature regime. The alluvial deposits, however, extend to great depths where hot fluids, heated by the normal geothermal gradient, could be encountered. Two potential models for tapping geothermal energy are presented: the basin model and the fault model. DOE

N81-27651# Sandia Labs., Albuquerque, N. Mex. Central Receiver Test Facility Div.
HELIOSTAT OPERATION AT THE CENTRAL RECEIVER TEST FACILITY Technical Report, Oct. 1978 - Dec. 1980
J. T. Holmes May 1981 23 p refs
(Contract DE-AC04-76DP-00789)
(SAND-81-0275) Avail: NTIS HC A02/MF A01

The data and conclusions reported are for 222 CRTF heliostats. The CRTF beam produces a total power of 5.5 MWth and a peak intensity of 2250 KW/sq m near solar noon. Improvements in the targeting accuracy were made. The mirror reflectivity is maintained near 80% by cleaning with natural rains or snow. The CRTF logged almost 300,000 operating hours by the end of 1980. DOE

N81-27652# Sandia Labs., Albuquerque, N. Mex.
SYSTEMATIC ROTATION AND RECEIVER-LOCATION ERROR EFFECTS ON PARABOLIC-TROUGH ANNUAL PERFORMANCE
George H. Treadwell and Norman R. Grandjean Apr. 1981 13 p refs
(Contract DE-AC04-76DP-00789)
(SAND-81-0159) Avail: NTIS HC A02/MF A01

The technique for calculating the influence of systematic errors on performance is outlined. Methods for identifying and minimizing these errors are suggested. DOE

N81-27653# Sandia Labs., Albuquerque, N. Mex. Experimental Systems Operation Div.
MIDTEMPERATURE SOLAR SYSTEMS TEST FACILITY PREDICTIONS FOR THERMAL PERFORMANCE BASED ON TEST DATA. TOLTEC TWO-AXIS TRACKING SOLAR COLLECTOR WITH 3M ACRYLIC FILM REFLECTOR SURFACE
Thomas D. Harrison Jun. 1981 15 p refs
(SAND-80-1964/12) Avail: NTIS HC A02/MF A01

The solar collector has potential for use in industrial process heat and enhanced oil recovery applications. Predictions are for three output temperatures at five cities in the United States. T.M.

N81-27654# Sandia Labs., Livermore, Calif. Energy Systems Studies Div.

COMPARISON OF ALTERNATIVE WASHING SYSTEMS FOR HELIOSTATS

A. Kerstein Apr. 1981 23 p refs

(Contract DE-AC04-76DP-00789)

(SAND-81-8207) Avail: NTIS HC A02/MF A01

Two methods are proposed for washing heliostat mirrors in a solar central receiver facility. One method involves truck mounted washing mechanisms continuously traversing the heliostat field, washing mirrors sequentially on a fixed schedule. The other concept involves a washing unit affixed to each heliostat, permitting near simultaneous washing of all heliostats on demand. The former, scheduled washing system has the advantage of lower capital costs, while the latter, responsive system has more operational flexibility. Cost benefit evaluation of the two systems, taking into account the random nature of rainfall patterns and soiling processes, indicates that the scheduled system is preferable. DOE

N81-27655# Kaman Aerospace Corp., Bloomfield, Conn.

DEVELOPMENT OF A 40-KILOWATT WIND TURBINE GENERATOR. PHASE 1: DESIGN AND ANALYSIS

Henry E. Howes, Michael A. Bowes, and Richmond Perley Feb. 1981 296 p Prepared for Rockwell International Corp., Golden, Colo.

(Contract DE-AC04-76DP-03533)

(RFP-3094-2) Avail: NTIS HC A13/MF A01

Kaman Aerospace Corporation is currently engaged in a program to design, fabricate and test a horizontal axis wind turbine generator capable of producing 40 kW electrical output power in a 20 mph wind. The results covering design tradeoff studies, preliminary design and analysis and the final design effort are presented. Additional work included cost studies and test planning activities. DOE

N81-27656# South Carolina Energy Research Inst., Columbia.

RESIDUAL ENERGY APPLICATIONS PROGRAM TEST AND OPERATIONS REPORT

F. H. Zander and F. J. McCrosson Oct. 1980 97 p

(Contract DE-AC09-77ET-12866)

(DOE/ET-12866/4) Avail: NTIS HC A05/MF A01

Objective of the Residual Energy Applications Program is the recovery of waste heat at US gaseous diffusion plants by 1984. Included are: policy, objective, and guideline suggestions for utilizing the proposed Energy Applied Systems Test (EAST) Facility and for managing EAST operations; preliminary design information on facility support equipment and physical plant; and estimates of initial construction costs and staffing requirements for a two bay, three shift operation. DOE

N81-27657# Sirrine (J. E.) Co., Greenville, S.C.

ENERGY UTILIZATION. MUNICIPAL WASTE INCINERATION Final Report

M. F. LaBeck 27 Mar. 1981 100 p

(Contract DE-AC02-80CS-40400)

(DOE/CS-40400/T1) Avail: NTIS HC A05/MF A01

An assessment is made of the technical and economical feasibility of converting municipal waste into useable energy. The concept presented involves retrofitting an existing municipal incinerator with the systems and equipment necessary to produce process steam and electric power. The cost of necessary waste heat recovery equipment is usually a comparatively small percentage of the cost of the original incinerator installation. Technical data obtained from presently operating incinerators designed specifically for generating energy document the technical feasibility and stipulate design constraints. The investigation includes: a cost summary; description of process and facilities; conceptual design; economic analysis; derivation of costs; itemized estimated costs; design and construction schedule; and some drawings. DOE

N81-27658# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

FACT SHEETS RELATING TO USE OF GEOTHERMAL ENERGY IN THE UNITED STATES

Dec. 1980 284 p refs

(Contract DE-AI01-79ET-27025)

(DOE/ET-27025/T1) Avail: NTIS HC A13/MF A01

A compilation of data relating to geothermal energy in each of the 50 states is presented. The data are summarized on one page for each state. Following the summary data sheet are additional data on the geology of each state pertaining to possible hydrothermal/geothermal resouces. A list of some of the reports available pertaining to the state and state energy contacts is included. DOE

N81-27659# Los Alamos Scientific Lab., N. Mex. Solar Energy Group.

SOLAR ENERGY RESEARCH AT LOS ALAMOS Progress Report, 1 Apr. - 30 Sep. 1980

Sherry K. Reisfeld, comp. and Donald A. Neeper, comp. Mar. 1981 45 p refs

(Contract W-7405-eng-36)

(LA-8782-PR) Avail: NTIS HC A03/MF A01

Research is described on collector testing, the National Security and Resources Study Center active system study, monitored buildings data analysis, and performance predictions for passive solar heated buildings. Salinity gradient solar pond theoretical calculations, the thermosyphon collector experiment, and solar materials analysis and testing are described. Accounts are also given of technical support to the Office of Solar Applications for Buildings, US Department of Energy, and of technology transfer to the scientific community, building industry, government departments, and the general public. DOE

N81-27660# Oak Ridge National Lab., Tenn. Energy Div.

ENERGY-SAVING IMPACTS OF DOE'S CONSERVATION AND SOLAR PROGRAMS. (AN ORNL/MITRE STUDY PERFORMED IN 1980). VOLUME 2: HISTORICAL TRENDS, DETAILS OF SECTORAL ANALYSIS, AND APPENDIXES

R. W. Barnes, J. L. Blue, D. M. Boyd, K. R. Corum, R. Gerstein, D. L. Greene, D. M. Hamvlin, E. Hirst, H. Hoffman, and G. Kamp May 1981 491 p refs

(Contract W-7405-eng-26)

(ORNL/TM-7690/V2) Avail: NTIS HC A21/MF A01

Energy and oil impacts were estimated under a common set of assumptions concerning rising energy prices and economic growth. Historical trends in U.S. energy consumption, buildings and community systems, industry, transportation, solar, energy storage systems, and Energy Management Partnership Act are titles of sections presented. Information presented in the appendices includes: existing energy legislation; research, development, and demonstration projects included in the OIP program analysis; regionalization of transportation sector inputs; national solar legislation; and the Energy Management Partnership Act and related acts. DOE

N81-27661# Battelle Columbus Labs., Ohio.

BATTERY STORAGE ON THE CUSTOMER SIDE OF THE METER ASSESSMENT Final Report

F. J. Bates, J. E. Clifford, M. L. Duchi, T. R. Martineau, and J. C. Skelton 25 Feb. 1981 365 p refs

(Contract W-7405-eng-92)

(BMI-2078) Avail: NTIS HC A16/MF A01

An appropriate battery system for customer side, and near term, demonstration and subsequent commercialization was chosen and evaluated in sufficient depth and clarity to form a solid technology base for the customer side regulatory, institutional, economic, and market potential evaluation. The choice of batteries for a base system is lead-acid. Recognizing the potential near term availability of zinc-chloride batteries, a sensitivity analysis of battery system viability for this system was also conducted. A view of long term future, customer side viability was prepared using DOE battery storage goals. Electric customer ownership, siting, and operation of battery systems requiring the evaluation of many different issues from those relevant to utility ownership are discussed. DOE

N81-27662# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

COST OF ENERGY FROM SOME RENEWABLE AND CONVENTIONAL TECHNOLOGIES, FY 1980 Progress Report

Apr. 1981 114 p refs

(Contract DE-AC02-77CH-00178)

(SERI/SP-741-1022) Avail: NTIS HC A06/MF A01

Up to date consistent and transparent estimates of the cos delivered energy from a selected number of solar and renewable technologies were developed and these were compared with the costs of conventional alternatives meeting the energy needs in comparable applications. Technology characterizations and cost assessments of representative systems relating to 23 solar and renewable resouce technology/application pairs were performed. For each pair, identical assessments were also made for representative conventional (e.g., fossil fuel) competing systems. The standardized methodology developed to do the technology characterizations and cost assessments is summarized. Assessments of technology/application pairs relating to distributed applications are presented, as well as central system assessments. DOE

N81-27663# SRI International Corp., Menlo Park, Calif.
HYDROCARBON REFORMING FOR HYDROGEN FUEL CELLS Annual Report, 1 Oct. 1979 - 30 Sep. 1980
C. Hart, P. Y. Hou, R. M. Laine, J. G. McCarty, D. Sheridan, H. A. Wise, and B. J. Wood 30 Jan. 1981 54 p refs
(Contract DE-AC21-79MC-11323; SRI Proj. PYU-1038)
(DOE/MC-11323/T1) Avail: NTIS HC A04/MF A01

The mechanism of carbon formation on nickel autothermal steam reforming catalysts was studied by temperature programming, thermogravimetric, and electron microscopic techniques. Temperature programmed surface reaction (TPSR) studies of carbon deposited on nickel reforming catalysts by the decomposition of ethylene exhibit seven forms of carbon that are distinguished by their characteristic reactivity with H2 and 3.0 vol percent H2O/He. The relative population of the different carbon states depends primarily on the temperature during deposition. The reactivity of the carbon states are not altered by exposure to steam in C2H2-H2O mixtures, but the amount of carbon deposited decreases to zero as the H2O/C increases past a critical ratio. Critical steam to carbon ratios were measured in the presence of C2H4-H2O mixtures so as to establish the carbon formation boundary for several alumina supported nickel, Ni-Rh, and Ni-Ir alloy catalysts. The critical H2O/C ratio measured with a gravimetric balance decreased from approx. 30 at 7730 K to approx. 1 at 10730 K for all the catalysts studied. DOE

N81-27664# Public Technology, Inc., Washington, D. C.
LOCAL GOVERNMENT USE OF THERMOGRAPHY FOR ENERGY CONSERVATION. AN INFORMATION BULLETIN OF THE ENERGY TASK FORCE OF THE URBAN CONSORTIUM
1980 37 p refs
(Contract DE-FG02-78IR-05106)
(DOE/IR-05106/T7) Avail: NTIS HC A03/MF A01

Information is presented on the capabilities of various thermal infrared sensing technologies and equipment. Examples of their use in inventories of energy loss from both individual buildings and community wide perspectives are included. Discussions cover both ground and aerial surveys and include procedures for program evaluation. Two case studies of cities are presented. A tabular comparison of equipment specifications is presented and listings of experts, organizations, and reference sources for further detailed information are given. DOE

N81-27665# Oak Ridge Y-12 Plant, Tenn. Dept. of Fabrication Systems.
OAK RIDGE FLYWHEEL EVALUATION LABORATORY Annual Report, 1 Oct. 1979 - 30 Sep. 1980
R. S. Steele, Jr., E. F. Babelay, Jr., and B. F. Sutton 30 Apr. 1981 42 p refs
(Contract W-7405-eng-26)
(Y-2233) Avail: NTIS HC A03/MF A01

Summaries are given for the ultimate speed evaluations of one flywheel built by Union Carbide Corporation, Nuclear Division (UCC-ND); four flywheels constructed under subcontracts from Sandia National Laboratory, Albuquerque; one fabricated by Lawrence Livermore National Laboratory; and one manufactured by General Electric Company. Also included are the test results from two momentum transfer tests of the UCC-ND designed flywheel. Prototype crash rings were used in a number of these tests, and a discussion of their performance is included. DOE

N81-27666# Oak Ridge National Lab., Tenn.
SUMMARY OF THE RESEARCH AND DEVELOPMENT EFFORT ON THE SUPERCRITICAL CO2 CYCLE
A. P. Fraas Jun. 1981 21 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6236) Avail: NTIS HC A02/MF A01

The supercritical CO2 cycle has the advantage over a conventional closed cycle gas turbine in that the compression work phase of the cycle can be carried out close to the critical point and hence aerodynamic losses in the compressor are reduced and the cycle efficiency increased for a given turbine inlet temperature. However, the practicable turbine inlet temperature is reduced by permissible stresses in the heater tubes because the peak pressure in the cycle must be approx. 260 atm in order to have the compression process take place close to the critical point of the working fluid. The high system pressure also makes the capital cost of the heat exchangers and gas piping higher than that for a conventional closed cycle gas turbine. Further, the waste heat from the cycle must be rejected at too low a temperature for it to be useful for industrial process heat or for district heating systems. DOE

N81-27667# Oak Ridge National Lab., Tenn.
ACES: FINAL PERFORMANCE REPORT Final Report, 1 Dec. 1978 - 15 Sep. 1980
Van D. Baxter Apr. 1981 138 p refs
(Contract W-7405-eng-26)
(ORNL/CON-64) Avail: NTIS HC A07/MF A01

The performance of the ACES in a single family residence near Knoxville, Tennessee was compared with that of two different air to air heat pumps in an identical house. Results show that energy was saved for the testing years. In addition to reducing consumption, the ACES significantly reduced integrated peak utility demands. Reinsulation of the ice storage bin reduced heat leakage rates by about 40 percent and resulted in increasing ground temperatures by an average of 5.60 C over first year levels. The demonstration project and the ACES concept are described. Data acquisition procedures, system modifications, steady state performance, annual cycle performance, and effects of modifications are discussed. DOE

N81-27668# Argonne National Lab., Ill.
US/USSR COOPERATIVE PROGRAM IN OPEN-CYCLE MHD ELECTRICAL POWER GENERATION JOINT TEST REPORT NO. 4. TESTS IN THE U-25B FACILITY MHD GENERATOR TESTS NO. 6 AND 7
B. F. Picologlou, ed. and V. M. Batenin, ed. Jan. 1981 240 p refs
(Contract W-31-109-eng-38)
(ANL-IVTAN-JT-4) Avail: NTIS HC A11/MF A01

The MHD generator was operated at its design parameters. New plasma diagnostic devices are described and include: a traversing dual electrical probe for determining distribution of electron concentrations, a traversing probe that includes a pitot tube for measuring total and static pressure, and a light detector for measuring plasma luminescence. Data are presented on heat flux distribution along the channel, the forest data of this type obtained for an MHD facility of such size. Results are given of experimental studies of plasma characteristics, gasdynamic, thermal, and electrical MHD channel performance, and temporal and spatial nonuniformities. DOE

N81-27669# Rockwell International Corp., Golden, Colo. Energy Systems Group.
CONTROLLED VELOCITY TESTING OF SMALL WIND ENERGY CONVERSION SYSTEMS. AN EVALUATION OF A TECHNIQUE
J. C. Balcerák Nov. 1980 50 p refs
(Contract DE-AC04-76DP-03533)
(RFP-3189) Avail: NTIS HC A03/MF A01

A test machine was mounted on a rail flatcar which was pushed by a locomotive. The primary objective of the test was to determine the usefulness of SWECS controlled velocity testing (CVT) using this method. Wind velocity profiles, acceleration/deceleration forces, rotor yaw, power output, rotor rpm, power coefficient, wake measurements, and flow visualization were examined in these tests. The results confirm the potential benefit

of this method as an addition to the natural atmospheric testing done at the Rocky Flats Wind Systems Test Center. DOE

N81-27670# Public Technology, Inc., Washington, D. C.
DECISION PROCESS FOR THE RETROFIT OF MUNICIPAL BUILDINGS WITH SOLAR ENERGY SYSTEMS A TECHNICAL GUIDE
Nov 1980 212 p refs Prepared in cooperation with the City of Los Angeles
(Contract DE-FG02-78IR-05106)
(DOE/IR-05106/2) Avail: NTIS HC A10/MF A01

As a background for solar applications, the following topics are covered: solar systems and components for retrofit installations; cost, performance, and quality considerations; and financing alternatives for local government. The retrofit decision process is discussed as follows: pre-screening of buildings, building data requirements, the energy conservation audit, solar system sizing and economics, comparison of alternatives, and implementation. Sample studies are presented for the West Valley Animal Shelter and the Hollywood Police Station. DOE

N81-27671# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.
DESIGN REPORT: WESTINGHOUSE SECOND GENERATION HELIOSTAT. VOLUME 2: MANUFACTURING, INSTALLATION, TRANSPORTATION, AND COST ESTIMATES
Jun 1980 46 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-8193/2) Avail: NTIS HC A03/MF A01

A manufacturing plan is given to define the strategy to be used to build heliostats in large volume for solar central receiver power plants generating power commercially in field arrays of 3956 heliostats to produce 50 megawatts of electric power, and to show how the plan will be implemented. Plans are presented for parts and materials procurement, the needed capital equipment, plant equipment and production equipment. The processes for assembling and installing the heliostats, and the personnel required for the job are discussed, as well as field maintenance and quality control. Assembly plant capacity and the heliostat production schedule are estimated. Cost estimates are tabulated for production, operation and maintenance of heliostats. DOE

N81-27672# Associated Architects of Crested Butte, Colo.
GUNNISON COUNTY AIRPORT TERMINAL SOLAR COOPERATIVE AGREEMENT
Leon H. Waller and Jan F. Kreider 1981 39 p
(Contract DE-FC02-89CS-30339)
(DOE/CS-30339/1) Avail: NTIS HC A03/MF A01

The results of solar system performance studies carried out on the final construction of a passive space heating system for the Gunnison County Airport Terminal are presented. The principal topic discussed is the economic performance of the system with supporting material on thermal performance and system design. The conclusions of this study, using the methods of computer modeling and life cycle economics are: (1) the final design passive solar heating system with night insulation will provide, on the average, 41 percent of the annual heating load for the terminal; (2) the passive system will result in a saving of 154 million Btu per year or, equivalently, 45,122 kWh per year; and (3) over a 40 year period the system is expected to save 3.1 million dollars in heating energy costs after the solar system investment is paid off. DOE

N81-27673# Springborn Labs., Inc., Enfield, Conn.
PREVENTION OF SOILING OF HELIOSTAT SURFACES Final Report
Bernard Baum and Mark Binette 5 Dec. 1980 111 p
(Contract DE-AC04-76DP-00789)
(SAND-79-8182) Avail: NTIS HC A06/MF A01

Methods for preventing or minimizing soiling of the surface of the glass mirrored heliostat and the plastic dome over the aluminized Mylar mirror were developed. The substrates used were float glass, Kynar, and Petra A polyester. The two general classes of compounds which were being investigated were antistatic and antisoiling agents. The categories of antistatic agents used were amine derivatives, quaternary ammonium salts, phosphate esters, and polyethylene glycol esters. The soil release agents were either hydrophilic ionic or hydrophilic nonionic in character. These compounds were attached to the substrate surface by silane or titanate coupling agents or as a mixture with a hard, weather resistant coating. The silanol groups on the surface of glass provided suitable attachment sites; whereas, the plastic substrates required activation by various procedures. Another route to these objectives lay in direct reaction of an organic compound with a functional group in the glass surface. Evaluation of the various coatings on the three substrates was accomplished by a sequential screening procedure. DOE

N81-27674# Sun Trac Corp., Glenview, Ill.
COMMERCIALIZATION OF PHOTOVOLTAIC-CONCENTRATOR SYSTEMS Final Report, 13 Feb. 1978 - 31 Nov. 1979
Douglas E. Moeller and C. George Mates Feb. 1981 76 p
(Contract DE-AC04-76DP-00789)
(SAND-81-7001) Avail: NTIS HC A05/MF A01

Efforts to improve, fabricate, and test a prototype of a photovoltaic concentrator array are described. Low-cost compound parabolic concentrators, low material-content structures, light matrix structures, and low-cost, two axis tracking are discussed. The protoype combines low-cost assembly with high-volume production of components. The design incorporates a transparent rigid spherical enclosure that inhibits cell cooling and limits otpical efficiency, for an overall efficiency of about 5 percent. DOE

N81-27675# WESTEC Services, Inc., Albuquerque, N. Mex.
BACA GEOTHERMAL DEMONSTRATION PROJECT. POWER PLANT DETAIL DESIGN DOCUMENT
Feb. 1981 106 p Sponsored in part by Union Geothermal Company of New Mexico Prepared for Public Service Company of New Mexico
(Contract DE-FC03-78ET-27163)
(DOE/ET-27163/7) Avail: NTIS HC A06/MF A01

This Baca Geothermal Demonstration Power Plant document presents the design criteria and detail design for power plant equipment and systems, as well as discussing the rationale used to arrive at the design. Where applicable, results of in-house evaluations of alternatives are presented. DOE

N81-27676# Sandia Labs., Albuquerque, N. Mex. Systems Analysis Div.
ANALYTICAL MODELS FOR SOLAR-PHOTOVOLTAIC ENERGY-SYSTEM COMPONENTS
M. W. Edenburn Apr. 1981 147 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-2567) Avail: NTIS HC A07/MF A01

Analytical models for components used in solar photovoltaic energy systems were incorporated into subroutines that are part of the solar energy system analysis computer program SOLSYS. Array thermal models calculate cell temperature and illumination for flat, point focus, and line focus arrays. Electrical subsystem models compute array power output (based on array current voltage characteristics), battery parameters, and power conditioning equipment efficiencies. Cooling towers are modeled to determine coolant temperature for activity cooled arrays. A solar and weather data subroutine reads typical meteorological year tapes and computes solar azimuth and elevation angles. DOE

N81-27677# Sandia Labs., Livermore, Calif.
DESIGN, COST AND PERFORMANCE COMPARISONS OF SEVERAL SOLAR THERMAL SYSTEMS FOR PROCESS HEAT. VOLUME 5: SYSTEMS
P. J. Eicker, Joe D. Hankins, Larry D. Hostetler, Joseph J. Iannucci, and James B. Woodard Apr. 1981 78 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-8283-Vol-5) Avail: NTIS HC A05/MF A01

Conceptual designs were obtained for central receiver, parabolic dish and parabolic trough systems used in several industrial process heat applications. The estimated cost of energy from these systems is presented. The system level trade studies which determined the optimal collector spacings are discussed. The assumptions used in the study relative to economics, maturity of technologies, costs of nonsolar equipment, nomenclature, etc., are also presented. The appendices discuss the models used to calculate field performance and present detailed information on subsystem cost and performance. DOE

N81-27678# Sandia Labs., Livermore, Calif. Solar Programs Dept.
TESTING OF THE PROTOTYPE HELIOSTATS FOR THE SOLAR THERMAL CENTRAL RECEIVER PILOT PLANT
Apr. 1981 232 p refs Prepared in cooperation with Sandia National Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(SAND-81-8008) Avail: NTIS HC A11/MF A01

As part of the competition for production of heliostats for the pilot plant, the Martin Marietta Corporation and the McDonnell Douglas Astronautics Company each built prototype heliostats and components (drive mechanisms and mirror modules) which were subjected to an extensive test program by Sandia National Laboratories in 1979. An overview of the tests and their results are presented. Heliostat and controls tests, structural tests on the drive mechanism, environmenatl drive assembly tests, and mirror module tests are reported. DOE

N81-27679# Sandia Labs., Albuquerque, N. Mex.
MIDTEMPERATURE SOLAR SYSTEMS TEST FACILITY PREDICTIONS FOR THERMAL PERFORMANCE BASED ON TEST DATA. POLISOLAR MODEL POL SOLAR COLLECTOR WITH GLASS REFLECTOR SURFACE
Thomas D. Harrison May 1981 25 p ref
(Contract DE-AC04-76DP-00789)
(SAND-80-1964/11) Avail: NTIS HC A02/MF A01

Thermal performance predictions based on test data are presented for the Polisolar Model POL sola collector, with glass reflector surfaces, for three output temperatures at five cities in the United States. DOE

N81-27680# Esser (Klaus) G.m.b.H. and Co. K.G., Duesseldorf (West Germany). Bereich Entwicklung.
SOLAR COLLECTORS FOR FLAT ROOFS Final Report
Guenter Dohse and Guenter Reisewitz Bonn Bundesministerium fuer Forschung und Technologie Aug. 1980 30 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-043; ISSN-0340-7608;
BMFT-03E4017B/ETS8001A) Avail: NTIS HC A03/MF A01

The development and construction of solar collectors for flat roofs, preparation for production and service life qualification testing are described. Optimization of collector parts, considering the choice of material and manufacturing techniques, was investigated. The problematic nature of installation techniques which meet technical requirements and guarantee good operation is addressed. Solar collector heat transfer characteristics are shown satisfactory while wind tunnel and weathering environment tests demonstrate the ruggedness of engineering models. For connecting the collector to the interior piping, customized roof penetrating connector elements and pipe support brackets are used.
Author (ESA)

N81-27681# Promotor Verlags- und Foederungsges m.b.H., Karlsruhe (West Germany).
PESA: PRACTICAL EXPERIENCES WITH EXISTING SOLAR ENERGY INSTALLATIONS Final Report
Guenther Keller and Juergen Uhlig Bonn Bundesministerium fuer Forschung und Technologie Nov. 1980 79 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-073; ISSN-0340-7608) Avail: NTIS HC A05/MF A01

A total of 494 solar energy installations operating in the Federal Republic of Germany, were investigated by way of interviews with the owners and circulation of questionnaires. A representative number of each type of domestic solar energy system, presently in use, was surveyed, and data concerning installation (size, cost, difficulty), application (e.g., hot water, space heating), and maintenance were tabulated. Results provide basic data on solar energy technology as well as showing that approximately 80% of all solar plant owners are generally satisfied with their installations. Author (ESA)

N81-27682# Ruhrgas A.G., Essen (West Germany).
FUEL SAVINGS WITH CONVENTIONAL HOT WATER SPACE HEATING SYSTEMS BY INCORPORATING A NATURAL GAS POWERED HEAT PUMP. PRELIMINARY PROJECT: DEVELOPMENT OF HEAT PUMP TECHNOLOGY Final Report
Ludger vanHeyden and Erich Evertz Bonn Bundesministerium fuer Forschung und Technologie Dec. 1980 227 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-143; ISSN-0340-7608;
BMFT-03E5164A/ETS0004) Avail: NTIS HC A11/MF A01

Compression type air/water heat pumps were developed for domestic heating systems rated at 20 to 150 kW. The heat pump is driven either by a reciprocating piston or rotary piston engine modified to operate on natural gas. Particular features of natural gas engines as prime movers, such as waste heat recovery and variable speed, are stressed. Two systems suitable for heat pump operation were selected from among five different mass produced car engines and were modified to incorporate reciprocating piston compressor pairs. The refrigerants used are R 12 and R 22. Test rig data transferred to field conditions show that the fuel consumption of conventional boilers can be reduced by 50% and more by the installation of engine driven heat pumps. Pilot heat pumps based on a 1,600 cc reciprocating piston engine were built for heating four two-family houses. Pilot pump operation confirms test rig findings. The service life of rotary piston and reciprocating piston engines was investigated. The tests reveal characteristic curves for reciprocating piston engines and include exhaust composition measurements. Author (ESA)

N81-27683# Varta Batterie A.G., Kelkheim (West Germany). Forsch.-und Entwicklungszentrum.
DEVELOPMENT OF A LEAD ACID BATTERY WITH HIGH ENERGY AND POWER DENSITY Final Report
Karl-Ernst Baufeldt, Waldemar Borger, and Reinhard Braeutigam Bonn Bundesministerium fuer Forschung und Technologie Dec. 1980 220 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-151; ISSN-0340-7608;
BMFT-03E4046A/ETS0001A) Avail: NTIS HC A10/MF A01

The energy density of lead acid cells was increased to more than 50 Wh/kg for a 5 hr discharge. Improved design considerations included: (1) forced electrolyte flow through the active materials; and (2) a construction method with a checkered electrode arrangement based on minimized electrolytic and electronic conduction paths as well as optimized volume/surface area proportions. A method for rejuvenating negative plates was also studied. Hermetically sealed lead acid cells, suitable for electric vehicle applications, were constructed. Cycle life and performance tests show outstanding capacity (100 W/kg under heavy load, i.e., 1 hr discharge) and a 1500 cycle, problem free, service life. Author (ESA)

N81-27684# Volkswagen A.G., Wolfsburg (West Germany). Forschung und Entwicklung.
FUEL CONSERVATION IN CONVENTIONAL HOT WATER HEATING SYSTEMS BY INCORPORATING A GAS ORIENTED HEAT PUMP. DEVELOPMENT OF A HYBRID PISTON PUMP/PISTON ENGINE Final Report
Juergen Pohle and Bernd Wiedemann Bonn Bundesministerium fuer Forschung und Technologie Dec. 1980 176 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-152; ISSN-0340-7608;
BMFT-03E5165F/ETS00041) Avail: NTIS HC A09/MF A01

The possibility of reducing energy consumption 50% by utilizing an internal combustion engine, driving a heat pump connected to a conventional central heating system, is shown. Taking standard engines from motor vehicle production lines, then modifying them to run on natural gas, complete prototype heat pump systems with infrequent maintenance requirements and prolonged life were developed. The main feature of the modified engine design is that part of the block is used as a compressor for the pump. The manufacture of the engine is only practical if it is possible to reduce production costs to below that of existing compact units. Extensive field tests are recommended in order to prove the economy of the system.
Author (ESA)

N81-27685# Hydronamic N. V., Sliedrecht (Netherlands).
STUDY OF INFRASTRUCTURE CONSIDERATIONS FOR

MICROWAVE ENERGY GROUND RECEIVING STATIONS. SATELLITE POWER SYSTEM (SPS) OFFSHORE RECTENNA SITING STUDY IN WESTERN EUROPE. AN EXECUTIVE SUMMARY Final Report
A. R. Bresters Paris ESA Nov. 1980 26 p refs
(Contract ESTEC-4382/80-NL-PP(SC))
(P-495-Vol-1; ESA-CR(P)-1411-Vol-1) Avail: NTIS HC A03/MF A01

The feasibility of offshore rectenna sites in the North Sea based on a reference SPS concept of 5 GW was investigated. Site criteria include a 20 km wide safety zone between the site and the shore, a 300 km limit to centers of power consumption, and a water depth of 30 m. Artificial islands, polders, atolls and exposed gravity or jacket structures were considered. Only the island and polder concept permit antenna installation without modifications to the reference design. The polder concept was selected, costing half that of the artificial island (160 km sq). Construction material requirements are given for the dikes. Total construction time is 8.5 years. Costs range between 4.7 and 5.4 billion in 1980 dollars, or $0.02 per kw hr over 30 years.
Author (ESA)

N81-27686# National Bureau of Standards, Washington, D.C. Center for Building Technology.
ENERGY ANALYSIS OF A PROTOTYPE SINGLE-FAMILY DETACHED RESIDENCE: THE EFFECTS OF CLIMATE, HOUSE SIZE, ORIENTATION, INTERNAL HEAT RELEASE, AND NATURAL COOLING
James P. Barnett Jan. 1981 47 p refs Sponsored in part by DOE
(PB81-166514; NBSIR-80-2184) Avail: NTIS HC A03/MF A01 CSCL 10A

A computer study was done to determine how the annual heating and cooling requirements of a prototypical ranch-style house are affected by changes in four energy use parameters: climate; floor area; orientation; and internal heat generation. The effects of natural cooling on the annual cooling requirements were also investigated. GRA

N81-27687# National Bureau of Standards, Washington, D.C. National Engineering Lab.
NBS SOLAR COLLECTOR DURABILITY/RELIABILITY TEST PROGRAM PLAN Final Report
David Waksman, Elmer Streed, and James Seiler Jan. 1981 90 p refs Sponsored in part by DOE
(PB81-166571; NBS-TN-1136) Avail: NTIS HC A05/MF A01 CSCL 10A

The program is designed to evaluate both approved and proposed solar collector test procedures and to correlate laboratory, accelerated field and simulated operational exposures with actual field data. The tests and exposure procedures described determine the influence of environmental exposure parameters that could affect the degradation of solar collectors and their materials. They provide a correlation between changes that occur at the materials and the collector component levels. GRA

N81-27688# NEUS, Inc., Santa Monica, Calif.
BIOSOURCES DIGEST, JOURNAL ON BIOMASS UTILIZATION, VOLUME 2, NUMBER 4
Harry Sobel Oct. 1980 58 p refs
(Grant NSF PFR-77-12500)
(PB81-167058; NSF/RA-800383-Vol-2-No-4) Avail: NTIS HC A04/MF A01 CSCL 10A

The journal serves as an information exchange in biomass utilization for food, energy, chemicals, and materials. The following papers are presented in this issue: Energy and Forestry in Canada; Comparative Activity Profiles of Thielavia Terrestris and Trichoderma reesei Cellulases; Biogas: The Chinese Experience; Introduction to the Botany 1980 Symposium: Plants and Energy; and Biomass for Energy: Potentials in Arizona. Grant awards, publications received, recent publications, pertinent patents, and forth coming meetings are noted. GRA

N81-27689# Transportation Research Board, Washington, D.C.
TRANSPORTATION ENERGY: DATA, FORECASTING, POLICY, AND MODELS
Michael Morris, Antti Talvitie, David T. Hartgen, Nathan S. Erlbaum, Martin E. H. Lee, Matthew F. Glover, Donald A. Maxwell, Dennis V. Williamson, Nancy S. Dorfman, and Ian E. Harrington 1980 118 p refs
(PB81-172579; TRB/TRR-764; ISBN-0-309-03107-9; ISSN-0361-1981; LC-81-1665) Avail: NTIS HC A06/MF A01 Paper Copy also avail: Transportation Res. Board, 2101 Constitution Ave., N.W., Washington, D.C. 20418 CSCL 10A

The 16 papers in this report deal with the following: assessment of energy and petroleum consumption of different transportation modes in the Buffalo area; long range forecasts of transportation energy consumption in New York state; use of disaggregate data to evaluate gasoline conservation policies; evaluating the costs and benefits of plans to reduce gasoline queues; review of analytical models of gasoline demand during an energy emergency; direct energy accounts for urban transportation planning; transportation energy effects on urban growth; travel demand and estimation of energy consumption by a constrained model; and transportation system management actions a study of the energy costs. GRA

N81-27690# National Bureau of Standards, Washington, D.C. National Engineering Lab.
MEASUREMENT TECHNIQUES FOR SOLAR CELLS Final Annual Report, 15 Dec. 1978 - 14 Dec. 1979
D. E. Sawyer, K. K. Kessler, T. J. Russell, W. F. Lankford, and H. A. Schafft Jan. 1981 61 p refs Sponsored in part by Midwest Research Inst.
(PB81-163875; NBSIR-80-2181) Avail: NTIS HC A04/MF A01 CSCL 10B

The laser scanner was used to examine a variety of devices: Cu2S/Cds cells; silicon tandem junction cells; Zn3P2 Schottky diode specimens; and edge-fed growth polycrystalline silicon cells. It is possible to detect cell design and processing induced losses in conversion efficiency, areas of missing antireflection coatings, lack of ohmic contact of the metallization to the cell, breaks in cell metallization fingers, fine cracks, scratches, and silicon carbide inclusions. GRA

N81-27691# University of Southern California, Los Angeles. Dept. of Electrical Engineering.
SOLAR CELL MATHEMATICAL ANALYSIS AND COMPUTER SIMULATION Final Report
K. Lehovec and A. Fedotowsky Jan. 1981 74 p refs Sponsored in part by Midwest Research Inst.
(Contract NB-79-SBCA-0062)
(PB81-163891; NBS-GCR-80-285) Avail: NTIS HC A04/MF A01 CSCL 10B

Procedures are established which permit the calculation of cell output by spot illumination for various boundary conditions imposed by faults, provided the attenuation length is independent of position. The attenuation length is the distance over which the photosignal from the illuminated point diminishes to 1/e of its value due to the back flow of current over the distributed junction network modeled for the solar cell. Faults explicitly treated are: cracks with and without leakage current across the exposed junction; point shorts; and partial electrode life-offs. Procedures are established for calculating the effect of variation of the attenuation length with distance from the grid electrodes on the cell output. GRA

N81-27145*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ASSESSMENT OF SOLAR-ASSISTED GAS-FIRED HEAT PUMP SYSTEMS
F. L. Lansing *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 154-190 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 10A

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N81-27692*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF AIRCRAFT NOISE ON THE EQUILIBRIUM OF

AIRPORT RESIDENTS: LONGITUDINAL STUDY AROUND ROISSY, PHASE 3
Jacques Francois May 1981 104 p refs Transl. into ENGLISH of "Les Repercussions du Bruit des Avions sur l'Equilibre des Riverains des Aeroports: Etude Longitudinale autour de Roissy, Teme Phase" Paris, Sep. 1979 p 1-73 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original language doc. prep. by Inst. Francais d'Opinion Publique (IFOP), Paris (France) (Contract NASw-3198)
(NASA-TM-75906) Avail: NTIS HC A06/MF A01 CSCL 13B

The effects of airplane noise on the mental equilibrium of residents living near airports are discussed, and based on population sample surveys involving health questionnaires and self-administered personality tests. Progressive changes were observed on the part of residents living near a large airport. S.F.

N81-27693# Committee on Science and Technology (U. S. House).
OVERSIGHT: ENVIRONMENTAL IMPACT STATEMENT
Washington GPO 1980 237 p refs Hearing before the Subcomm. on Energy Develop. and Applications of the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., No. 156, 19 Sep. 1980
(GPO-69-196) Avail: Subcommittee on Energy Development and Applications

The need for greater cooperation between the EPA and DOE and clarification of policies regarding the environmental review process for major synthetic fuel demonstration projects are considered. The costs of various pilot projects and budgetary increases to be faced because of delays are examined. A.R.H.

N81-27694# California Univ., Irvine.
USE OF UNICELLULAR ALGAE FOR EVALUATION OF POTENTIAL AQUATIC CONTAMINANTS Annual Report, 1 Jun. 1979 - 31 May 1980
Jan Scherfig, Peter S. Dixon, Carol A. Justice, and Alberto Acevedo Carillo Wright-Patterson AFB, Ohio AFAMRL May 1981 41 p refs
(Contract F33615-76-C-5005; AF Proj. 6302)
(AD-A099701; AFAMRL-TR-80-85) Avail: NTIS HC A03/MF A01 CSCL 06/20

Several species of marine and freshwater algae were used in bioassays to determine the effects of potential aquatic contamination which might result from the use of hydrazine and shale derived fuel propellants. Techniques are described for both chronic and spill types of exposure and the results are each discussed. Compounds evaluated included hydrazine, monomethylhydrazine, unsymmetrical dimethylhydrazine and shale JP-8. Author (GRA)

N81-27695# WAPORA, Inc., Chevy Chase, Md.
POTENTIAL EFFECTS OF ENVIRONMENTAL REGULATORY PROCEDURES ON GEOTHERMAL DEVELOPMENT
Gene V. Beeland and David B. Boies Jan. 1981 100 p refs (Contract DE-AC01-80ET-27208)
(DOE/ET-27208/T2) Avail: NTIS HC A05/MF A01

The potential effects of several types of applicable environmental regulatory procedures on geothermal development were assessed, and problem areas were identified. The possible impact of procedures adopted pursuant to the following Federal statutes were analyzed: Clean Air Act; Clean Water Act; Safe Drinking Water Act; and Resource Conservation and Recovery Act. State regulations applicable, or potentially applicable, to geothermal facilities were also reviewed to determine: permit information requirements; prepermit air or water quality monitoring requirements; effect of mandated time frames for permit approval; and potential for exemption of small facilities. The regulations of the following states were covered in the review: Alaska; Arizona; California; Colorado; Hawaii; Idaho; Montana; Nevada; New Mexico; Oregon; Utah; Washington; and Wyoming. DOE

N81-27696# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
STUDY OF THE FORMATION OF SUBMICRON PARTICULATES GENERATED BY COAL COMBUSTION Quarterly Progress Report, 1 Jan. - 31 Mar. 1981
P. M. Sherman and D. R. Glass Apr. 1981 13 p
(Grant DE-FG22-80PC-30305)
(DOE/PC-30305/T2: QPR-2) Avail: NTIS HC A02/MF A01

A flame holder eliminated any problem of flash back or blow off. Installation of ceramic liners for access ports facilitated both the use of an optical pyrometer and a thermocouple traverse system. A heater was added for preheating secondary air. The dust feeder developed delivers a very steady rate of dust without the problems of a separate fluidizer. A safety system for quick fuels shut off in case of the flame flashing back into the mixing tube was also added. A sampler with a sonic orifice in a conical leading edge was designed and built for downstream sampling of sub micron particles. DOE

N81-27697# Department of Energy, Washington, D. C. Office of Environmental Compliance and Overview.
ENVIRONMENTAL COMPLIANCE GUIDE, VOLUME 1
Feb. 1981 357 p refs 2 Vol.
(DOE/EV-0132-Vol-1) Avail: NTIS HC A16/MF A01

The Guide is intended to assist Department of Energy personnel by provding information on the NEPA process, the process of other environmental statutes that bear on the NEPA process, the timing relationships between the NEPA process and these other processes, as well as timing relationships between the NEPA process and the development process for policies, programs, and projects. This information should be helpful not only in formulating environmental compliance plans but also in achieving compliance with NEPA and various other environmental statutes. The Guide is divided into three parts with related appendices: Part 1 provides guidance for developing environmental compliance plans for DOE actions; Part 2 is devoted to NEPA with detailed flowcharts depicting the compliance procedures required by CEQ regulations and Department of Energy NEPA Guidelines; and Part 3 contains a series of flowcharts for other Federal environmental requirements that may apply to DOE projects. DOE

N81-27698# Department of Energy, Washington, D. C. Office of Environmental Compliance and Overview.
ENVIRONMENTAL COMPLIANCE GUIDE, VOLUME 2
Feb. 1981 529 p refs 2 Vol.
(DOE/EV-0132-Vol-2) Avail: NTIS HC A23/MF A01

Volume 2 supplements Volume 1 in providing procedures, relative timing, and details to assist in achieving compliance with Federal environmental requirement. It is intended as a guide for Department of Energy personnel. DOE

N81-27699# Department of Energy, Bartlesville, Okla.
ENVIRONMENTAL, RESOURCE CONSERVATION, AND ECONOMIC ASPECTS OF USED OIL RECYCLING
D. W. Brinkman, M. L. Whisman (Waste Oil Consulting), N. J. Weinstein (RECON Systems, Inc.), and H. R. Emmerson (Petroleum Technology Energy Resources) Apr. 1981 62 p refs
(DOE/BETC-RI-80/11) Avail: NTIS HC A04/MF A01

In order to provide current and updated information, the case for burning used automotive lubricating oil versus re-refining was reevaluated based upon the 1980 American economy and energy conservation posture. In these comparisons, the environment is considered within four scenarios ranging from unrestricted burning of used oil without government constraints to complete prohibition of burning thereby funneling all used automotive lube oils to re-refining. The material and energy advantages to be realized in terms of resource conservation through either burning or re-refining, and an estimation of the economics and profit potential currently available in the disposition of used lube oil were examined. It is found that environmental concerns as presently regulated do not alone provide a persuasive case for re-refining over burning of used automotive lubricating oil. DOE

N81-27700# Meteorology Research, Inc., Santa Rosa, Calif.
AIRCRAFT MEASUREMENTS OF POLLUTANTS AND METEOROLOGICAL PARAMETERS DURING THE SULFATE REGIONAL EXPERIMENT (SURE) Final Report
D. L. Blumenthal, W. S. Keifer, and J. A. McDonald Apr. 1981 230 p refs
(EPRI Proj. 862-3)
(EPRI-EA-1909) Avail: NTIS HC A11/MF A01

Results of the aircraft measurements of pollutant and meteorological parameters performed during the Sulfate Regional

Experiment (SURE) are summarized. Air quality and meteorological data were obtained for development and verification of models which describe the dispersion and transformation of atmospheric sulfur compounds emitted from industrial sources in the northeastern United States. Airborne data from several instrumented aircraft were acquired to complement data obtained by a network of ground stations and to provide additional information about transport phenomena not available from ground data alone. The SURE aircraft program, locations, dates, times of each sampling flight made, and analyses performed to date are described. DOE

N81-27701# Iowa Univ., Iowa City. Environmental Chemistry Dept.

ANALYSIS OF TOLUENE TOXICITY AND ATMOSPHERIC DISPERSION FROM AN ORGANIC RANKINE BOTTOMING CYCLE SYSTEM Final Report

Apr. 1980 28 p refs Prepared in cooperation with Stanley Consultants, Muscatine, Iowa

(Contract DE-AC07-76ID-01570)

(IDO-10091) Avail: NTIS HC A03/MF A01

Leaks from the Organic Rankine Bottoming Cycle facility were modeled in three scenarios. The first case assumed a leak rate of one pound per hour. This resulted in a maximum concentration of 0.1 ppM, which is below the odor threshold and several times below the occupational exposure for 8 hour limits. Case 2 was the worst case situation when the entire amount of toluene is lost within a relatively small period of time. With a wind speed of 7 m per sec at distance of .2 km, the maximum concentration for a 15 min exposure is 23.2 ppM. In the Case 3 analysis, all of the toluene escaped into the PCC time building and then slowly dispersed from there. Depending upon the length of time the leak rate occurred, odors would be detectable up to 300 m from the plant and occupational exposure levels are exceeded at distances ranging from 45 to 160 m away. It is concluded that the potential exposures to toluene of both human and natural populations is minimal, and would occur in most cases, at levels below accepted standards. DOE

N81-27702# Argonne National Lab., Ill. Energy and Environmental Systems Div.

SHORT-TERM NITROGEN DIOXIDE MODELING: CURRENTLY AVAILABLE MODELS AND THE APPLICATIONS AND DEVELOPMENT NEEDED FOR ENERGY ASSESSMENT

K. C. Chun Nov. 1980 39 p refs

(Contract W-31-109-eng-38)

(ANL/EES/TM-132) Avail: NTIS HC A03/MF A01

Multiple interdependent factors that affect local short term concentrations of nitrogen dioxide such as meteorology, air quality, and the characteristics and distribution of emission sources of nitrogen dioxide precursors are discussed. The utility and limitations of existing air quality models for nitrogen dioxide, including empirical, mechanistic, and empirico-mechanistic models are evaluated. An approach for applying and developing relatively simple models for predicting short term concentrations of nitrogen dioxide in assessments of regional and national energy development are suggested. E.D.K.

N81-27703# Research Triangle Inst., Research Triangle Park, N. C.

AIRCRAFT MEASUREMENTS OF POLLUTANTS AND METEOROLOGICAL PARAMETERS DURING THE SULFATE REGIONAL EXPERIMENT (SURE)

J. B. Tommerdahl, J. H. White, R. B. Strong, J. E. Sickles, M. L. Saeger, and J. J. B. Worth Apr. 1981 194 p refs

(EPRI-EA-1912) Avail: NTIS HC A09/MF A01

Air quality and meteorological data were obtained for development and verification of models describing the nature and dispersion of atmospheric sulfur compounds emitted from industrial sources such as power plants. Airborne data from several instrumented aircraft were acquired to support ground-based data from a network of monitoring stations and to provide additional information about transport phenomena not available from ground station data alone. A twin engine aircraft was equipped with instrumentation for monitoring SO2, O3, NO, NO sub x, b sub scat, condensation nuclei, temperature, dew point, and turbulence. This aircraft was operated for approximately 40 hours of ambient air quality data sampling during each of six two week intensive monitoring periods spread over a one and one half year period. Flights performed usually consisted of three spiral flights from near ground level to 3060 meters. In addition, cross country flights were conducted during later intensives under episode conditions. Data from all flights were processed by computer, and stored on magnetic tape. DOE

N81-27704# Tetra Tech, Inc., Lafayette, Calif.

INTEGRATED LAKE-WATERSHED ACIDIFICATION STUDY (ILWAS): CONTRIBUTIONS TO THE INTERNATIONAL CONFERENCE ON THE ECOLOGICAL IMPACT OF ACID PRECIPITATION Interim Report

May 1981 87 p refs Conf. held at Sandefjord, Norway, 11-14 Mar. 1980

(EPRI Proj. 1109-5)

(EPRI-EA-1825) Avail: NTIS HC A05/MF A01

Lake acidification processes were investigated for three lake watershed basins in the Adirondack Park region of New York. The three basins (Woods, Sagamore, and Panther), receive similar amounts of acid deposition yet observable pH values for the lakes are very dissimilar indicating unequal acid neutralizing capacities among the watersheds. Specific emphasis is given to the following: a characterization of the geology, hydrology, limnology and vegetation of the three study sites; an analysis of acid precipitation quality and quatity; the effects of vegetative canopy; the effects of snowmelt; the effects of winter lake stratification; comparison of heavy metal transport; examination of acidic sources other than direct precipitation; assessment of lake acidification during spring thaw; and integration of all acidification components with a mathematical model. DOE

N81-27705# WESTEC Services, Inc., Albuquerque, N. Mex.

BACA GEOTHERMAL DEMONSTRATION PROJECT BASELINE ECOSYSTEM STUDIES OF COOLING TOWER EMISSION EFFECTS Interim Report

P. Leitner, R. Osterling, D. Price, and J. Westermeier Mar. 1981 30 p Sponsored in part by Union Geothermal Company of New Mexico Prepared for Public Service Company of New Mexico

(Contract DE-FC03-78ET-27163)

(DOE/ET-27163/6) Avail: NTIS HC A03/MF A01

Results of baseline studies for boron, arsenic, mercury, and fluorine in vegetation and soil near the Baca Geothermal Demonstration Power Plant are provided for the 1980 sampling season. Preliminary results of visual vegetation assessments and population density studies of soil invertebrate fauna are also provided. Boron, arsenic, mercury, and fluorine levels in centrations of soil arsenic and mercury were comparable to foliage concentrations. Boron concentrations were lower in soil then in foliage, whereas soil fluorine concentrations were considerably higher than foliage concentrations. With the exception of heavy insect infestations in June-July, no vegetation abnormalities were noted. Preliminary soil invertebrate analysis indicated an overall arthropod density of approximately 100,000/m(2) which appears within the normal range encountered in forest and meadow soil. DOE

N81-27706# Alaska Univ., Fairbanks. Geophysical Inst.

CARBON DIOXIDE IN ARCTIC AND SUBARCTIC REGIONS

Thomas A. Gosink and John J. Kelley Mar. 1981 125 p refs

(Contract DE-AT06-80EV-10429)

(DOE/EV-10429/1) Avail: NTIS HC A06/MF A01

A three year research project was presented that would define the role of the Arctic ocean, sea ice, tundra, taiga, high latitude ponds and lakes, and polar anthropogenic activity on the carbon dioxide content of the atmosphere is defined. Due to the large physical and geographical differences between the two polar regions, a comparison of CO2 source and sink strengths of the two areas was proposed. Research opportunities during the first year, particularly those aboard the Swedish icebreaker, YMER, provided additional confirmatory data about the natural source and sink strengths for carbon dioxide in the Arctic regions is provided. As a result, the hypothesis that these natural sources and sinks are strong enough to significantly affect global atmospheric carbon dioxide levels is considerably strengthened. It is theorized that the Whole Arctic region is a net annual sink for about 1.1 times 10 to the 15th power g of CO, or the

equivalent of about 5% of the annual anthropogenic input into the atmosphere. DOE

N81-27707# Ente Nazionale per l'Energia Electtrica, Rome (Italy). Centro di Ricerca Termica e Nuclear.

STUDY OF THE LOCAL ATMOSPHERE IN THE LA SPEZIA ZONE IN CONNECTION WITH ENEL THERMAL POWER STATION EMISSIONS FROM 1974 TO 1975 [STUDIO DELL'ATMOSFERA LOCALE NELLA ZONA DI LA SPEZIA IN RELAZIONE ALLE EMISSION DELLA CENTRALE TERMOELETTRICA ENEL: PERIODO 1974-1975]

D. Anfossi (CNR), P. Bacci, G. Elisei, V. Ghione, C. Giraud (CNR), A. Longhetto, A. Piano, and R. Richiardone (CNR) Feb. 1979 99 p In ITALIAN; ENGLISH summary

(ENEL-364) Avail: NTIS HC A05/MF A01

The actual meteorological and pollution parameters in the La Spezia gulf were measured during four consecutive campaigns. Measurements on a reduced scale model of the area were then compared in order to study the climatic effect of a power plant installation. Four climatological situations were analyzed: the adiabatic regime, sea breezes, the land breezes, and the winter inversion. These situations characterize 85% of the local climatology. It is concluded that the operating procedures of the power station are in general valid in relation to the alarm levels for the urban area. The reappearance of the pollutants accumulated during the night was not observed. Author (ESA)

N81-27708# Ludwig-Maximilians-Universitaet, Munich (West Germany).

INVESTIGATION OF AIR POLLUTION WITH A DIFFERENTIAL ABSORPTION TECHNIQUE Final Report

Walter Baumer and Karl W. Rothe Bonn Bundesministerium fuer Forschung und Technologie Nov. 1980 54 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-80-093; ISSN-0340-7608; BMFT-NT-1001; BMFT-NT-1001A; BMFT-13N5015; BMFT-NT-1120) Avail: NTIS HC A04/MF A01

A lidar system for the measurement of the three-dimensional distribution of atmospheric trace constituents, using differential absorption techniques, is proposed. A short laser pulse is emitted into the atmosphere and the backscattered light is recorded in function of time. The laser radiation is absorbed in a very specific way by the species to be measured. The concentration can be evaluated by performing measurements at different wavelengths. During two field measurement campaigns, the lidar setup was tested successfully. Results also demonstrate that vertical sections are very useful for propagation studies. The measuremens are compared with theoretical models based on simple and reasonable assumptions. From this both the diffusion parameters and the total mass emission of the source is estimated, which, obviously, is one of the key quantities for determining pollution level in the environment. Author (ESA)

N81-27709# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

NONISOTHERMAL ATMOSPHERIC DISPERSION MODEL FOR A GASEOUS POLLUTANT OF ANY DENSITY IN THE PRESENCE OF OROGRAPHIC NONUNIFORMITIES [MODELE DE DISPERSION ATMOSPHERIQUE NON-ISOTHERME D'UN POLLUTANT GAZEUX DE DENSITE QUELCONQUE EN PRESENCE DE NON-UNIFORMITES OROGRAPHIQUES]

Andre Foussat Jan. 1981 65 p refs In FRENCH; ENGLISH summary

(VKI-TN-135) Avail: NTIS HC A04/MF A01

A mathematical model describing the behavior of a gas of any density released into a turbulent atmosphere was developed. A numerical treatment was established for two dimensional flow. An understanding of the effects of accidental or continuous release was explored. The mean velocity and temperature fields characterizing the atmosphere were calculated with a turbulence model. Pollutant concentration distributions were detemined from these results. The model enabled three types of curve to be determined: standard concentration/altitude and concentration distance from source curves; isoconcentration curves at levels required for toxicity, inflammability studies, etc; and particle localization curves, which enable the shape of plumes or pollutant clouds to be determined. Author (ESA)

N81-27710# Colorado State Univ., Fort Collins. Dept. of Civil Engineering.

DETECTION OF WATER QUALITY CHANGES THROUGH OPTIMAL TESTS AND RELIABILITY OF TESTS

Roy W. Koch, Thomas G. Sanders, and Hubert J. Morel-Seytoux Sep. 1980 138 p refs

(Contract DI-14-34-0001-8069)

(PB81-161028; COMPLETION-104; W81-01466; OWRT-B-186-COLO(2)) Avail: NTIS HC A07/MF A01 CSCL 13B

The detection of change in a hydrologic variable, particularly in water quality, is a current problem. A method of formulating this problem in a mathematical programming context is presented. The method is based on using weighted linear combinations of water quality variables from different locations with the weighting factors being adjusted so that the time required to detect the change is minimized. The basis of the technique, then, is a trade-off of time by adding information from other locations. The results of example applications show that significant savings in time can be achieved by using this method. GRA

N81-27711# National Inst. for Occupational Safety and Health, Cincinnati, Ohio. Organic Methods Development Section.

INVESTIGATION OF AN AIR SAMPLING AND ANALYTICAL METHOD FOR METHYL ETHYL KETONE PEROXIDE

Julie R. Okenfuss and Judd C. Posner 19 Aug. 1980 24 p refs

(PB81-167868) Avail: NTIS HC A02/MF A01 CSCL 06F

A method was developed to determine methylethyl ketone peroxide (1338234) (MEKO) in air, based on a series of tests on stability, the effects of temperature, time and oxygen, the effects of freezer storage, collection efficiency and vapor storage, use of teflon filters, and the effects of ketones on absorbance. MEDO was collected in a midget impinger containing 15 milliliters of dimethyl phthalate. A portion of the solution was treated with diphenylcarbonhydrazide color reagent and heated to produce a violet color. The reaction was read spectrophotometrically at 565 nanometers and compared to values for known MEKO standards. The range of the method was 0.31 to 3.1 milligrams per cubic meter, and the limit of detection was 25 micrograms per 100 milliliters. This method provides rapid sample collection and does not require sample edition or desorption, however the midget impingers are awkward to use in sample collection and the color reaction is relatively nonspecific. GRA

N81-27712# Research Triangle Inst., Research Triangle Park, N. C.

QUALITY ASSURANCE GUIDELINES FOR ENVIRONMENTAL HEALTH RESEARCH

P. A. Cunningham, K. W. Gold, T. J. Hughes, L. E. Myers, and C. E. Tatsch Jan. 1981 149 p refs

(Contract EPA-68-02-3226)

(PB81-172678; EPA-600/2-81-006) Avail: NTIS HC A07/MF A01 CSCL 06F

Conceptual guidelines are provided for the development, implementation and evaluation of research task quality assurance plans for the staff of the Health Effects Research Laboratory (HERL/RTP) of the U.S. Environmental Protection Agency. The quidelines describe the HERL-RTP Quality Assurance (QA) organization and the QA responsibility of both management and technical research personnel in relation to the mandatory Agency QA policy and task data quality requirements. Specific guidelines for atmosphere generation, dose monitoring and animal research are included. GRA

N81-27713# Systems Applications, Inc., San Rafael, Calif.

METHODOLOGY FOR DESIGNING AN OPTIMUM AIR QUALITY MONITORING NETWORK

Kei-Kao Liu and Joel Avrin Feb. 1981 60 p refs

(Contract EPA-68-03-2446)

(PB81-171191; Rept-158-EF79-146R4; EPA-600/4-18-002) Avail: NTIS HC A04/MF A01 CSCL 13B

A two step objective method is presented for determining the optimum number and disposition of ambient air quality stations in a monitoring network. The method uses a data base consisting

of a comprehensive set of simulated or measured air quality patterns representative of the region of interest. In the first step, the most desirable monitoring locations are identified and ranked. The minimum number of required locations is determined in the second step through eliminating redundancies among the locations identified in the first step with regard to spatial coverage over the region of interest. As a demonstration, the method is applied to the Las Vegas Valley of Nevada for the pollutant species carbon monoxide. GRA

N81-27714# Environmental Monitoring and Support Lab., Las Vegas, Nev. Advanced Monitoring Systems Div.
DEVELOPMENT OF A HELICOPTER WATER QUALITY MONITORING/SAMPLING SYSTEM
H. Michael Lowry Feb. 1981 53 p refs
(PB81-168734; EPA-600/4-81-005) Avail: NTIS HC A04/MF A01 CSCL 13B

The system was developed for use by the National Eutrophication Survey and subsequently used in support of other water quality projects. The salient problems associated with the use of a helicopter as a sampling platform and the modifications made in the system to fulfill the needs are described. GRA

N81-27715# Environmental Protection Agency, Washington, D.C. Office of Research and Development.
ENVIRONMENTAL OUTLOOK, 1980
Aug. 1980 839 p refs
(PB81-163453; EPA-600/8-003) Avail: NTIS HC A99/MF A01 CSCL 13B

Progress in long range research and development planning process, an overview of likely environmental futures, and an interpretation and analysis of potentially significant future environmental problems are reported. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N81-27716 British Library Lending Div., Boston Spa (England). Meteorological Office.
THE USE OF TEMPERATURE TOTALS IN COMPUTING HEAT FLUX INTO THE SOIL
G. Kh. Tseytin 1 Jul. 1980 12 p refs Transl. into ENGLISH from Glav. Geof. Obs., T. Vyp. 423 (Leningrad), 1979 p 113-119
(BLL-Trans-1470-(9022.549)) Avail: British Library Lending Division, Boston Spa, England

The heat conduction equation for a horizontally homogeneous soil when the temperature varies only with depth and time is the first step in a procedure described for using temperature total to reduce the number of observations required to compute heat fluxes into the soil. The use of totals lessens the effect of random fluctuations in individual observations which is important with regard to the temperature of soil surface which has a marked measurement error. Examples are given showing the advantages of calculating with temperature totals by comparing them with analogous calculations using discrete temperatures. A.R.H.

N81-27717 British Library Lending Div., Boston Spa (England). Article Translating Service.
THE MECHANICS OF GEOLOGICAL FRACTURE PHENOMENA. A CONTRIBUTION TO THE PROBLEM OF FEATHER CRACKS
W. Riedel Dec. 1980 25 p Transl. into ENGLISH from Zentralbl. fur Mineral. Geol. und Palaontol. (West Germany), no. 13, 1929 p 354-368
(BLL-RTS-12408) Avail: British Library Lending Div., Boston Spa, England

In many cases the interrelationship between all factors important in fracture formation cannot be discerned because of the frequently large inhomogeneities in geologic bodies, the indefinite nature of the external forces, and the effects of time and temperature. Fracture must often be regarded as the final consequence of multiple progressively occurring movements within the fabric of stone geological bodies. An experiment using clay and water is used to demonstrate the deformation processes in geological masses which can be regarded as rupture processes and can give rise to tectonic structures. The occurrence of both tension and shear cracks is studied as well as an echelon systems of feather cracks at the limit of movement between two geological masses where the acute angle is always directed against the direction of movement. A.R.H.

N81-27718 British Library Lending Div., Boston Spa (England). Article Translating Service.
EXPERIMENTS ON INNER STRUCTURE
H. Cloos Feb. 1981 18 p refs Transl. into ENGLISH from Centralblatt for Mineral. Geol. und Palaontol. (West Germany), 1928 p 609-621
(BLL-RTS-12412) Avail: British Library Lending Div., Boston Spa, England

A test arrangement is described which is suitable for investigating the relationship of fissures, cracks, and displacements with mainly plastic movements (folds and flows). Recommended for the study and teaching of tectonics, the tests clarify the dependence of larger forms on movement. During manipulation of the test equipment, a clay mass carries out all the main structural movements. It flows without breaking, producing bends, folds, overthrusts, and flexures. By conducting the experiment under water or pouring an amnion over the clay before, during, or shortly after the movement, the clay breaks up momentarily and collectively yields those flow formations associated with break phenomena. The break up of the tension or of the shear cracks can be influenced by the method and timing of adding water. A.R.H.

N81-27719 British Library Lending Div., Boston Spa (England). Meteorological Office.
THE SOLAR RADIATION REGIME OF AFRICA
T. G. Berlyand 1 Apr. 1980 29 p refs Transl. into ENGLISH from Glav. Geof. Obs. (Leningrad), no. 263, 1970 p 3-18
(BLL-Trans-1433-(9022.549)) Avail: British Library Lending Div., Boston Spa, England

Actinometric data from 79 stations in Africa are analyzed. The data is based on a minimum of 5 years of global solar radiation (Q) observations. Data from representative tropical, subtropical, and equatorial stations for the months of June and December are presented. The monthly mean of Q, the annual variation of the standard deviation and of the coefficient of variation of Q, the frequency of daily values of Q for different classes of intensity, and the annual amplitude and annual variations of Q are determined. The ratios of diffuse radiation D to the Global radiation Q and the annual variation of D/Q are calculated. The day to day variability of Q, the relative day to day variability of Q, and annual variations of the relative variability in Q are determined. Isoplethic maps are presented. J.D.H.

N81-27720*# New Hampshire Univ., Durham. Space Science Center.
ROCKET STUDY OF AURORAL PROCESSES Final Report, 1 May 1978 - 30 Jun. 1981
Roger L. Arnoldy 30 Jun. 1981 77 p refs
(Grant NsG-6022)
(NASA-CR-164534) Avail: NTIS HC A05/MF A01 CSCL 04A

Abstracts are presented of previously published reports analyzing data from three Echo 3 rocket flights. Particle experiments designed for the Terrier-Malmute flight, the Echo 5 flight, and the Norwegian Corbier Ferdinand 50 flight are described and their flight performance evaluated. Theoretical studies on auroral particle precipitation are reviewed according to observations made in three regions of space: (1) the region accessible to rockets and low altitude satellites (few hundred to a few thousand kilometers); (2) the region extending from 4000 to 8000 km (S3-3 satellite range); and (3) near the equatorial plane (geosynchronous satellite measurements). Questions raised about auroral arc formation are considered. A.R.H.

N81-27721*# California Univ., Berkeley. Space Sciences Lab.
SOUNDING ROCKET RESEARCH ARIES/FIREWHEEL,

SERIES 22, ISSUE 15 Final Report, 1 Jun. 1968 - 28 Feb. 1981
Forrest S. Mozer 28 Feb. 1981 109 p refs
(Grant NGR-05-003-239)
(NASA-CR-174637) Avail: NTIS HC A06/MF A01 CSCL 04A

Rocket experiments in ionospheric particle and field research flow in seven programs during the last decade are summarized. Experimental techniques were developed and are discussed including the double-probe field technique. The auroral zone, polar cap, and equatorial spread F were studied. T.M.

N81-27722*# National Aeronautics and Space Administration, Washington, D. C.
PHOTOMETRIC AND RADAR OBSERVATIONS OF AN EXCITED ERUPTION IN THE ZARNITSA-2 EXPERIMENT
T. G. Adeyshvili, Yu. F. Zarnitskiy, S. B. Lyakhov, G. G. Managadze, and A. Kh. Pyatsi Jul. 1980 17 p refs Transl. into ENGLISH of "Fotometricheskiye i Radiolokatsionnyye Nablyudeniya Stimulirovaogo Vysypaniya v Eksperimente Zarnitsa-2" rept. Pr-388, Moscow, 1978 18 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Inst. of Space Research, Academy of Sciences (USSR), Moscow
(NASA-TM-76216; Pr-388) Avail: NTIS HC A02/MF A01 CSCL 04A

In a controlled experiment a ground photometer and radar station recorded an increase in night sky luminescence following injection of an electron beam into the atmosphere from a rocket at altitudes 80 to 154 km. A main and supplementary scattering and luminescene regions were observed. The effect is presumed to be due to electron eruption induced by artificial action on the magnetosphere. Author

N81-27723*# Lamont-Doherty Geological Observatory, Palisades, N. Y.
STRAIN BUILDUP AND RELEASE, EARTHQUAKE PREDICTION AND SELECTION OF VBL SITES FOR MARGINS OF THE NORTH PACIFIC Final Progress Report
C. H. Scholz, R. Bilham, and T. L. Johnson Jul. 1981 15 p
(Grant NGR-33-008-146)
(NASA-CR-164561) Avail: NTIS HC A02/MF A01 CSCL 08K

During the past year, the grant supported research on several aspects of crustal deformation. The relation between earthquake displacements and fault dimensions was studied in an effort to find scaling laws that relate static parameters such as slip and stress drop to the dimensions of the rupture. Several implications of the static relations for the dynamic properties of earthquakes such as rupture velocity and dynamic stress drop were proposed. A theoretical basis for earthquake related phenomena associated with slow rupture growth or propagation, such as delayed multiple events, was developed using the stress intensity factor defined in fracture mechanics and experimental evidence from studies of crack growth by stress corrosion. Finally, extensive studies by Japanese geologists have established the offset across numerous faults in Japan over the last one hundred thousand years. These observations of intraplate faulting are being used to establish the spatial variations of the average strain rate of subregions in southern Japan. Author

N81-27724*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Lab. for Extraterrestrial Physics.
MULTIPLE CROSSINGS OF A VERY THIN PLASMA SHEET IN THE EARTH'S MAGNETOTAIL
D. H. Fairfield, E. W. Hones, Jr. (LASL, Los Alamos, N. M.), and C.-I. Meng (APL, Laurel, Md.) Jun. 1981 40 p refs
(NASA-TM-82147; Rept-695) Avail: NTIS HC A03/MF A01 CSCL 04A

High resolution magnetic field, plasma and energetic particle data from the IMP-8 spacecraft were studied for multiple crossings of the Earth's magnetotail plasma sheet when it becomes thin during magnetospheric substorms. Traversals recur on a time scale of several minutes and they are associated with high velocity plasma flows that are usually directed tailward but are occasionally directed earthward for brief intervals. Observations are explained by rapid oscillations of a plasma sheet that is only a few thousand km thick, a dimension comparable to the gyroradius of energetic protons. Differences in the angular distributions of the two energies indicate that the higher energy protons are preferentially located on field lines deeper in the tail lobe. A neutral line acceleration model is supported tailward streaming energetic electrons which are occasionally present at the lobe plasma sheet interface. E.A.K.

N81-27725*# Institute for Atmosphere Optics and Remote Sensing, Hampton, Va.
INVESTIGATION OF MULTIPLE SCATTERING EFFECTS IN AEROSOLS Final Report, Sep. 1978 - Dec. 1979
Adarsh Deepak 30 May 1980 187 p refs
(Contract NAS8-33135)
(NASA-CR-161816; IFAORS-143) Avail: NTIS HC A09/MF A01 CSCL 04A

The results are presented of investigations on the various aspects of multiple scattering effects on visible and infrared laser beams transversing dense fog oil aerosols contained in a chamber (4' x 4' x 9'). The report briefly describes: (1) the experimental details and measurements; (2) analytical representation of the aerosol size distribution data by two analytical models (the regularized power law distribution and the inverse modified gamma distribution); (3) retrieval of aerosol size distributions from multispectral optical depth measurements by two methods (the two and three parameter fast table search methods and the nonlinear least squares method); (4) modeling of the effects of aerosol microphysical (coagulation and evaporation) and dynamical processes (gravitational settling) on the temporal behavior of aerosol size distribution, and hence on the extinction of four laser beams with wavelengths 0.44, 0.6328, 1.15, and 3.39 micrometers; and (5) the exact and approximate formulations for four methods for computing the effects of multiple scattering on the transmittance of laser beams in dense aerosols, all of which are based on the solution of the radiative transfer equation under the small angle approximation. E.D.K.

N81-27726# Mission Research Corp., La Jolla, Calif.
MEASUREMENT OF THE ELECTRICAL PROPERTIES OF HIGHLY DOSED AIR IN THE MILLISECOND REGIME Topical Report, 15 Jan. - 15 Oct. 1980
J. G. Chervenak and V. A. J. VanLint 24 Oct. 1980 63 p refs
(Contract DNA001-80-C-0076)
(AD-A099984; MRC-SD-R-64) Avail: NTIS HC A04/MF A01 CSCL 18/3

An experiment was performed to measure the conductivity of air after the air had received a megarad dose. The ratio of the electron mobility to the attachment rate and the ratio of the ion mobility to the ion-ion recombination coefficient were found to be the same for highly dosed air and undosed air.
Author (GRA)

N81-27727# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
ENVIRONMENTAL REPORT ON THE NORTHWEST PACIFIC FOR THE MARINE SEISMIC SYSTEM (MSS) Report, 1 Dec. 1978 - 31 Sep. 1980
James A. Green and Peter Fleischer Dec. 1980 229 p refs
(ARPA Order 3693)
(AD-A099820; NORDA-31) Avail: NTIS HC A11/MF A01 CSCL 08/10

This report presents data compilations to aid in planning and site selection for the Marine Seismic System (MSS). Data are compiled for two geographic areas: the Northwest Pacific (40-56 N, 145-170 E) and the Kuril-Kamchatka earthquake region. Included for the Northwest Pacific are cultural, meteorological, oceanographic, geological, geophysical and seismological data to define the environment in which the potential MSS will operate. Kuril-Kamchatka earthquake zone data consist of seismic velocity structure of the crust and upper mantle and earthquake hypocenters. Author (GRA)

N81-27728# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
OPTOACOUSTIC SPECTROSCOPY OF C2H4 AT THE 9 MICROMETERS AND 10 MICROMETERS C-12O2-16 LASER WAVELENGTHS Final Report
R. J. Brewer (Zurich Univ.), Charles W. Bruce, and J. L. Mater

(Management/Marketing Associates, Inc., Portland, Oreg.) Mar. 1981 44 p refs
(DA Proj 1L1-61102-B-53A)
(AD-A099887; ERADCOM/ASL-TR-0080) Avail: NTIS HC A03/MF A01 CSCL 07/4

Absorption coefficients were measured for ethylene in the 9 micron and 10 micron range with an optoacoustic spectrophone. Pressure dependency in the 10P CO2 range was studied for various concentrations of ethylene. Comparisons of the data to other measurements of both atmospheric and pressure dependent absorption coefficients were also made, and a method for relating ethylene pressure dependency data on absorption to molecular structure was examined. Typical discrepancies between up to six independent measurements of ethylene absorption were 38 1 percent at the 10 micron R(20) line, 4.4 percent at the 10 micron P(18) line, and 18.5 percent at the 10 micron P(26) laser line GRA

N81-27729# Defense Mapping Agency Hydrographic and Topographic Center, Washington, D.C.
GENERAL PURPOSE LEAST-SQUARES ADJUSTMENT OF IPS DATA
D. S. Zimmerman and H. C. Harris 13 May 1981 13 p refs Presented at the Intern. Symp. on Inertial Technol. for Surveying and Geodesy, Banff, Alberta
(AD-A099727) Avail: NTIS HC A02/MF A01 CSCL 12/1

Many of the IPS survey projects can easily be designed to form an interconnected network which lends itself to adjustment by the least-squares method. While a rigorously modeled IPS adjustment procedure has not yet been developed, DMA has been using a general purpose least-squares adjustment program for several years on IPS networks. The technique and results are discussed. Author (GRA)

N81-27730# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
GLOBAL AURORAL IMAGING INSTRUMENTATION FOR THE DYNAMICS EXPLORER MISSION
L. A. Frank, J. D. Craven, K. L. Ackerson, M. R. English, R. H. Eather, and R. L. Carovillan Jan. 1981 45 p refs Submitted for publication
(Contract N00014-76-C-0016)
(AD-A099748; U-of-Iowa-81-5) Avail: NTIS HC A03/MF A01 CSCL 22/2

The instrumentation for gaining global images of the auroral oval from the high altitude spacecraft of the Dynamics Explorer Mission is described. Three spin scan auroral imaging (SAI) photometers are expected to be able to effectively view the dim emissions from the Earth in the presence of strong stray light sources near their fields of view along the sunlit portion of the spacecraft orbit. A special optical design which includes an off axis parabolic mirror as the focusing element and super reflecting mirror surfaces is used to minimize the effects of stray light. The rotation of the spacecraft and an instrument scanning mirror provide the two dimensional array of pixels comprising a image frame. The full width of the fields of view of the photometers corresponding to a single pixel is 0.29 deg. The angular dimensions of a typical full frame are 30 deg x 30 deg and span 1.44 x 10,000 pixels. The images from all three photometers are telemetered simultaneously with a repetition rate that can vary from about 3 t0 12 minutes. GRA

N81-27731# Denver Univ., Colo. Dept. of Mathematics.
VELOCITY INVERSION PROBLEM: PRESENT STATUS, NEW DIRECTIONS
Norman Bleistein and Jack K. Cohen 1980 53 p refs Presented at the 50th Ann. Intern. Meeting of the Soc. of Exploration Geophysicists, Houston, Tex., Nov. 1980 Sponsored in cooperation with Navy
(Contract DE-AC02-80ER-10769)
(DOE/ER-10769/3; MS-R-8110) Avail: NTIS HC A04/MF A01

The research program in seismic exploration in progress in the Mathematics Department of the University of Denver is described. This work is identified here by the term velocity inversion. The mathematical formulations employed are outlined and results of computer implementation are depicted. Ongoing research is also reported. DOE

N81-27732# California Univ., Livermore. Lawrence Livermore Lab. Test Ban Treaty Verification Program.
NATIONAL SEISMIC STATIONS TRANSDUCERS AND FILTERS
P. W. Rodgers and M. Hummell 13 Jan. 1981 25 p refs
(Contract W-7405-eng-48)
(UCRL-53098) Avail: NTIS HC A02/MF A01

Complete block diagrams of the KS-36000 and S-700 NSS seismometers and filters are presented. Both open loop and closed loop steady state amplitude and phase curves are given. Without band-pass filters (but with shaping filters) the KS-36000 has a flat (i.e., between the -3dB points) velocity sensitivity from 0.03 to 23 Hz. With its shaping filters, the S-700 is flat from 0.2 to 40 Hz. The structure of the three band-pass filters (LP, MP, and SP) is superimposed on these velocity sensitivities. Passbands of the resulting overall velocity sensitivity for the KS-36000 are as follows: LP band = 0.01-0.05 Hz, MP band = 0.02-1.3 Hz, and SP band = 1-10 Hz. Step-function responses and phase and group delays are given for each of the bands. The MP-band step response is oscillatory due to its sharp, high-frequency cutoff, but an MP-band filter with a less abrupt cutoff eliminates the oscillation. DOE

N81-27733# Sandia Labs., Albuquerque, N. Mex.
SANDIA TECHNOLOGY
May 1981 25 p refs
(Contract DE-AC04-76DP-00789)
(SAND-81-0564-Vol-5-No-3) Avail: NTIS HC A02/MF A01

General information is provided on technical programs at Sandia Laboratories. Three such programs are described: terradynamics, in which penetrators probe the Earth's response to high speed intrusion; Auger electron spectroscopy; and the national seismic station program, in which monitoring stations placed inside Russia could detect nuclear tests. DOE

N81-27734# Sandia Labs., Albuquerque, N. Mex.
COPES: CURRENT OR POTENTIAL ELECTRODE SELECTOR
Kenneth B. Kimball and Carl A. Denney Apr. 1981 27 p refs
(Contract DE-AC04-76DP-00789)
(SAND-81-0031) Avail: NTIS HC A03/MF A01

The selector was built to help automate earth resistivity measurements. It provides convenient means to switch electrodes in an array between the excitation current source and the potential measuring equipment. Probe configurations may be selected manually or by computer control to make measurements with various effective depth of penetration and resolution. DOE

N81-27735# Alaska Univ., Fairbanks. Geophysical Inst.
OPERATION OF A TELEMETERED SEISMIC NETWORK ON THE ALASKA PENINSULA Annual Report
Feb. 1981 19 p ref
(Contract DE-AT06-76ER-70006)
(DOE/ER-70006/7; RLO-2229-T6-7) Avail: NTIS HC A02/MF A01

The operation of a large aperture network of eleven short period seismic stations on the Alaska peninsula and several offshore islands is described. The network acquired data for the study of the seismotectonics of a part of the Alaska-Aleutian arc-trench structure. The system provided seismic coverage at a low magnitude threshold level (M sub L = 2.0). An event detection system was installed and fine tuned. Focal mechanism studies of intermediate depth Benioff zone earthquakes were also conducted. Analysis of the combined data from the network and a temporary array of ocean bottom seismometers, indicate that epicenter of earthquakes in the continental shelf area off Kodiac Island are shifted landward by about 15-km with respect to the epicenters determined from the combined data set. Other Significant results are reported. R.C.T.

N81-27736# Research Inst. of National Defence, Stockholm (Sweden).
INTERNATIONAL SEISMOLOGICAL DATA CENTER. OUTPUT OF AN EXPERIMENTAL DATA BASE
Gunnel Barkeby Nov. 1980 158 p refs
(FOA-C-20382-T1) Avail: NTIS HC A08/MF A01

Temporary international seismological data center facilities were set up at the Hagfors Observatory. The facilities are for

the compilation of an experimental data base and computer programs for automatic and interactive analysis of seismic data. The analysis includes three parts: (1) defining and associating short period observations; (2) associating long period observations; and (3) calculation of short period identification parameters for seismic events. The output of the automatic analysis is listed for a one week demonstration period. Results are considered adequate for verifying compliance with a comprehensive test ban on underground nuclear explosions. Author (ESA)

N81-27737# Research Inst. of National Defence, Stockholm (Sweden).

INTERNATIONAL SEISMOLOGICAL DATA CENTER: PREPARATION OF AN EXPERIMENTAL DATA BASE

Hans Israelson, Ingvar Jeppsson, and Gunnel Barkeby Nov. 1980 30 p refs

(FOA-C-20383-T1) Avail: NTIS HC A03/MF A01

An experimental data base compiled for a temporary international seismological data center is presented. Data include recording and measurements at 60 globally distributed seismological stations for a one week period. Data for definition, location and magnitude estimation of seismic events are examined. Original digital records from 11 seismological research observatories around the world are also analyzed to provide additional identification data. It is shown that the routine measurement and reporting of data at seismological stations as proposed by the Seismic Experts Group at the UN Committee of Disarmament, is an onerous task that goes far beyond current seismological practices. Author (ESA)

N81-27738# Research Inst. of National Defence, Stockholm (Sweden).

INTERNATIONAL SEISMOLOGICAL DATA CENTER: COMPILATION OF IDENTIFICATION DATA

Hans Israelson Nov. 1980 33 p refs

(FOA-C-20384-T1) Avail: NTIS HC A03/MF A01

The problem of compiling data for identifying seismic events is adressed. Such data compilation would be conducted by special international data centers as part of a system to monitor compliance with a comprehensive test ban on underground nuclear explosions. Temporary international seismological data center facilities were set up at the Hagfors Observatory. Identification parameters were limited to short period P waves. Results illustrate the necessity of introducing station corrections before compiling multistation data for a seismic event. Author (ESA)

N81-27739# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

METHODS FOR INTERPRETING ATMOSPHERIC SPECTRAL OBSERVATIONS BY SUN SIGHTING THROUGH THE EARTH LIMB Ph.D. Thesis - Paris Univ. 6

Gerard Eichen 1981 77 p refs In FRENCH; ENGLISH summary Sponsored by DGRST Report will also be announced as translation (ESA-TT-715)

(ONERA-NT-1981-2; ISSN-0078-3781) Avail: NTIS HC A05/MF A01

The methods for interpreting atmospheric spectral observations performed by the method of Sun occultation are reviewed. The methods based on measurements of absorption line areas are compared with each other from a theoretical viewpoint, then with concrete examples. Preference is given to an iterative method, which makes the final solution largely independent from the initial vertical profile. A method entirely based on the calculation of synthetic spectra is studied from a theoretical viewpoint. Examples of results are given from simulated observations. Conclusions are drawn, applicable to the experiment, to be performed on the first Spacelab payload. Author (ESA)

N81-27740# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Data and Information Service.

UNITED STATES EARTHQUAKES, 1978

Carl W. Stover, ed. (Geological Survey, Washington) and Carl A. VonHake, ed. 1980 122 p refs

(PB81-164717; NOAA-81013009) Avail: NTIS HC A06/MF A01 CSCL 08K

This publication describes all earthquakes that were reported felt in the United States and nearby territories in 1978. The publication is composed of four major chapters: 'Earthquake Descriptions,' which includes a summary of macroseismic data reported for each earthquake and a chronological list of earthquakes by State; 'Network Operations,' which summarizes the results from local seismic networks; 'Miscellaneous Activities,' which contains information on crustal movement studies, tsunamis, and principal earthquakes of the world; and 'Strong-Motion Seismograph Data'. The intensity and macroseismic data are compiled from questionnaire canvasses, newspaper articles and reports prepared by other government organizations, state institutions, local organizations, and individuals. Each description includes data, origin time, hypocenter, and hypocenter source of the earthquake, maximum intensity (Modified Mercalli), and macroseismic effects reported in the area. GRA

N81-27741# Sydney Univ. (Australia). Civil Engineering Labs.

SOME PLASTICITY SOLUTIONS RELEVANT TO THE BEARING CAPACITY OF ROCK AND FISSURED CLAY

E. H. Davis Jul. 1980 43 p refs

(PB81-150815; R-370) Avail: NTIS HC A03/MF A01 CSCL 08G

The theoretical effects of semibrittle behavior and the presence of defects on the stability of soil and rock masses were examined. For simplicity, attention is restricted to surface bearing capacity of the mass under plane strain conditions, and, for the most part, ignoring the effect of density of the material. Attention is also restricted to failure of the mass due to a monotonically increasing load or single load application. GRA

N81-27742# Atmospheric and Environmental Research, Inc., Cambridge, Mass.

STUDY OF THE ROLE OF TRANSPORT IN FINE AND TOTAL SUSPENDED PARTICULATE AIR QUALITY Final Report, Oct. - Nov. 1980

Haluk Oezkaynak, Volker A. Mohnen, John D. Spengler, Ronald G. Isaacs, P. Barry Ryan, Jack D. Shannon, Nien Dak Sze, Malcolm K. W. Ko, Lance F. Bosart, and George D. Thurston Feb. 1981 1025 p refs

(Contract NCAQ-18-AQ-9127)

(PB81-168031; AQ-9127-18) Avail: NTIS HC A99/MF A01 CSCL 04A

Current knowledge of the formation and long range transport of fine particulates is assessed. A literture review addresses the physical and chemical issues pertaining to the transport and removal of fine particulates and their precursors. An analysis of case studies which evaluates the contribution of long range transport of particulates to ambient air quality, visibility reduction, and acid rain is included. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N81-27743 British Library Lending Div., Boston Spa (England). Meteorological Office.

THE POSSIBILITY OF USING THE PRESSURE TENDENCY EQUATION FOR SHORT-RANGE FORECASTS OF THE SURFACE PRESSURE FIELD

R. Yu. Valner 2 Jul. 1980 22 p refs Transl. into ENGLISH from Alma-Ata, Kazakh. Nauch. - Issled. Gidromet. Inst., T. Vyp. 71 (USSR), 1978 p 18-32

(BLL-Trans-1459-(9022.549)) Avail: British Library Lending Division, Boston Spa, England.

A method of short range pressure forecasting at sea level based on the pressure tendency equation is presented. The equation is derived using only one assumption: the statics equation is used to integrate the continuity equation in an air column extending from the surface to the upper boundary of the atmosphere. The tendency equation, being admittedly coarse grained, is employed to provide qualitative explanations of the causes of pressure variation. Its direct application to quantitative analysis and to pressure forecasting is bound up with a range of difficulties, two of which are described. E.D.K.

N81-27744 British Library Lending Div., Boston Spa (England). Meteorological Office.

THE PRESENT STATE OF CLIMATOLOGY, AND ITS TASKS AND PROGRAMME DURING THE TENTH FIVE-YEAR PLAN

S. A. Sapozhnikova 2 Jul. 1980 7 p Transl. into ENGLISH from Vses. Nauch. - Issled. Inst. Gidromet. Inf. Mirov. Tsent. Danny., T. Vyp. 63 Moscow, 1979 p 5-9
(BLL-Trans-1461-(9022.549))

The status of Soviet climatology at the end of the ninth five-year plan and the requirements for future observations are discussed. The value of climatological data is reviewed. The standardization of meteorological instruments and data reduction methods are considered. The comparability of older and newer climatological data and the problems this raises in the use of older data in computing current weather anomalies is considered. Standardization of climatological data in handbooks is considered, and several Soviet climatology handbooks are reviewed. The modern capabilities of climatology and meteorology, particularly methods of typifying time series, are discussed. The work of agroclimatologists is considered. The integration of climatological data by area and the capabilities of microclimatology are discussed. J.D.H.

N81-27745 British Library Lending Div., Boston Spa (England). Meteorological Office.

THE FORMATION OF ARCHIVES OF HOMOGENEOUS DATA ON AIR TEMPERATURE

G. T. Gnevko 2 Jul. 1980 12 p refs Transl. into ENGLISH from Vses. Nauch. - Issled. Inst. Gidromet. Inf. Mirov. Tsent. Danny., T. Vyp. 63, Moscow, 1979 p 27-32
(BLL-Trans-1462-(9022.549)) Avail: British Library Lending Division, Boston Spa, England.

The problems connected with the creation of archives of meteorological information held in modern computer based storage media for subsequent use in the USSR Hydrometeorological Data Bank are discussed. Selection of the optimal averaging period in computing statistically sound norms for long term climatic characteristics is treated in great detail. L.F.M.

N81-27746 British Library Lending Div., Boston Spa (England). Meteorological Office.

AUTOMATIC CONTROL OF THE DATA ARCHIVE USED IN STATISTICAL WEATHER FORECASTING Final Report

A. A. Bagautdinov 2 Jul. 1980 6 p refs Transl. into ENGLISH FROM Novosibirsk, Zapad-Sibirsk, Reg. Nauch. - Issled. Gidromet. Inst., T. Vyp. 39 (USSR), 1978 p 31-83
(BLL-Trans-1463-(9022.549)) Avail: British Library Lending Division, Boston Spa, England

The control program for a weather data archive is described. The archive stores data from 13 stations in Western Siberia on surface pressure and temperature, geopotential, and air temperature. Algorithms for error correction are discussed. M.G.

N81-27747 British Library Lending Div., Boston Spa (England). Meteorological Office.

ON THE LINKING OF FLIGHT SCHEDULES TO THE CLIMATIC CHARACTERISTICS OF AIRPORTS

A. K. Baldykova and K. V. Mukasheva 1 Jul. 1980 5 p Transl. into ENGLISH from Alma-Ata, Kazakh. Nauch. Issled. Gidromet. Inst., T. Vyp. 71, (USSR), 1978 p 58-61
(BLL-Trans-1468-(9022.549)) Avail: British Library Lending Division, Boston Spa, England

At particular times of day the probability that visibility will worsen or the cloud cover lower to dangerous limits is much higher than at other times. Although it is quite a complicated matter to change centrally organized flight time tables which take into account a multiplicity of factors, it is an easier task to time table with regard to the climatic features of airports. If there is a good match between the time table and the climatic characteristics of the take off and landing points, it is possible to lessen the number of flight irregularities and thus curtail losses. Author

N81-27748 British Library Lending Div., Boston Spa (England). Meteorological Office.

ANNUAL VARIATION AND VARIABILITY OF METEOROLOGICAL PARAMETERS IN THE STRATOSPHERE AND MESOSPHERE

D. A. Tarasenko 1 Apr. 1980 9 p refs Transl. into ENGLISH from Tsent. Aerol. Obs. (Moscow), no. 140, 1978 p 10-18
(BLL-Trans-1439-(9022.549)) Avail: British Library Lending Div., Boston Spa, England

Using data from stations located in the Eastern Hemisphere, the variability of the upper atmosphere was estimated and a more precise idea of the mean monthly long-term distributions of pressure and temperature was obtained. The effect of processes in the stratosphere and mesosphere on the vertical correlations between meteorological elements is discussed. T.M.

N81-27749 British Library Lending Div., Boston Spa (England). Meteorological Office.

STATISTICAL ANALYSIS OF A 200-YR SERIES OF AIR TEMPERATURES IN NORTHERN EUROPE

A. N. Lyubarskiy 1 Apr. 1980 12 p refs Transl. into ENGLISH from Vses. Nauch - Issled. Inst. Gidromet. Inf. Mirov. Tsent. Danny. (USSR), 1978 p 245-253
(BLL-Trans-1432-(9022.549)) Avail: British Library Lending Div., Boston Spa, Engl.

Data from the following stations were analyzed: Berlin, Copenhagen, Stockholm, Oslo, Trondheim, Bergen, Edinburgh, and Leningrad. Temperatures at these stations exhibit a 2-3 year rhythm overlaid on the long-period fluctuations. Despite the substantial contribution of the variability of high-frequency 'noise' to the general variability of the system of fluctuations, the regular nature of climatic variation holds true. T.M.

N81-27750 British Library Lending Div., Boston Spa (England). Meteorological Office.

RADAR IDENTIFICATION OF DUST-STORMS

A. A. Fedorov and V. D. Stepanenko 1 Apr. 1980 7 p refs Transl. into ENGLISH from Glav. Geof. Obs., T. Vyp. 411 (Leningrad), 1978 p 71-75
(BLL-Trans-1438-(9022.549)) Avail: British Library Lending Div., Boston Spa, England

Estimates of the transport distance of soil particles for moderate to strong winds are given. Dust storms arising with the passage of a cold front and those arising in a storm zone are characterized. The structure of dust storms is considered, and the concentration of dust is computed from the known distribution of the concentration of soluble aerosols with height. A graph of particle concentration in dust storms as a function of height up to 1 km is presented. The concentration and size of dust particles found at heights above 1 km are considered. Beginning with the particle concentration, the radar detection range of a dust storm is calculated. Specific scattering volume as a function of particle size is given, as is the detection range as a function of the specific scattering volume. The maximum range for the MRL-2 apparatus is determined to fluctuate between 1/2 to 120 km depending on the value of the effective scattering cross section for unit volume. J.D.H.

N81-27751*# National Aeronautics and Space Administration, Washington, D. C.

CALCULATION OF THE ATTENUATION AND PHASE DISPLACEMENT PER UNIT OF LENGTH DUE TO RAIN COMPOSED OF ELLIPSOIDAL DROPS

Dario Maggiori Jan. 1981 56 p refs Transl. into ENGLISH of "Calcolodella Attenuazione e dello Sfasamento per unita di Lunghezza Dovuti a pioggia Conctituita da Gocce Ellissoidali, Rept. RIF-1B1778 8, Rome, May 1978 Translation announced as N80-28613 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Fondazione Ugo Bordoni (Contract NASw-3198)
(NASA-TM-76592; RIF-1B1778) Avail: NTIS HC A04/MF A01 CSCL 04B

All of the phenomena which influence the propagation of radiowaves at frequencies above 10 GHz (attenuation, depolarization, scintillation) can by intensified by parameters directly derived from a solution of individual scatter, naturally in addition to be meteorological elements which characterize the physical medium. The diffusion caused by rainy precipitation was studied using Mie's algorithm for rain composed of spherical drops, and Oguchi's algorithm for rain composed of drops in an ellipsoidal form with axes of rotational symmetry arrange along the vertical line of a generic reference point. Specific phase displacement and

attenuation along the principal planes, propagation of radiowaves in generic polarization, and propagation with inclined axes are also considered. DOE

N81-27752*# City Univ. of New York, N. Y.
SOME EFFECTS OF TOPOGRAPHY, SOIL MOISTURE, AND SEA-SURFACE TEMPERATURE ON CONTINENTAL PRECIPITATION AS COMPUTED WITH THE GISS COARSE MESH CLIMATE MODEL
J. Spar and C. Cohen Jul. 1981 32 p refs
(Grant NGR-33-016-086)
(NASA-CR-164562) Avail: NTIS HC A03/MF A01 CSCL 04B

The effects of terrain elevation, soil moisture, and zonal variations in sea/surface temperature on the mean daily precipitation rates over Australia, Africa, and South America in January were evaluated. It is suggested that evaporation of soil moisture may either increase or decrease the model generated precipitation, depending on the surface albedo. It was found that a flat, dry continent model best simulates the January rainfall over Australia and South America, while over Africa the simulation is improved by the inclusion of surface physics, specifically soil moisture and abedo variations. E.A.K.

N81-27753# Meteorological Satellite Center, Tokyo (Japan).
METEOROLOGICAL SATELLITE CENTER TECHNICAL NOTE, NO. 2
Oct. 1980 131 p refs Partly in JAPANESE and ENGLISH
Avail: NTIS HC A07/MF A01

Contents: (1) solar noise interference with GMS downlink; (2) matching the HIRS/2 and AVHRR pictures of TIROS-N satellites; (3) photoprocessing and the optical characteristics of satellite pictures; (4) comparison of GMS image data with rainfall data from the automated meteorological data acquisition system; (5) comparison of satellite derived cloud wind and rawinsonde data; (6) accuracy of the precipitable water estimated from the infrared radiation data of GMS; (7) examination of the reliability of densitometric analysis; and (8) the TIROS-N/NOAA A-G satellites. A.R.H.

N81-27754*# System Planning Corp., Arlington, Va.
SHIPBOARD FISHERIES MANAGEMENT TERMINALS Final Report
Robert G. Nagler and Earl V. Sager Oct. 1980 120 p refs
(Contract NAS5-26088)
(NASA-CR-166695; SPC-635; SPC-80-4470) Avail: NTIS HC A06/MF A01 CSCL 04B

The needs of the National Marine Fisheries Service (NMGS), National Weather Service, and the U.S. Coast Guard for locational, biological, and environmental data were assessed. The fisheries conservation zones and the yellowfin tuna jurisdiction of the NMFS operates observer programs on foreign and domestic fishing vessels. Data input terminal and data transfer and processing technology are reviewed to establish available capability. A matrix of implementation options is generated to identify the benefits of each option, and preliminary cost estimates are made. Recommendations are made for incremental application of available off the shelf hardware to obtain improved performance and benefits within a well bounded cost. Terminal recommendations are made for three interdependent shipboard units emphasizing: (1) the determination of location and fishing activity; (2) hand held data inputting and formatting in the fishing work areas; and (3) data manipulation, merging, and editing. E.A.K.

N81-27755# Committee on Science and Technology (U. S. House).
CENTRALIZED STORM INFORMATION SYSTEM
Washington GPO 1980 22 p Hearing before the Subcomm. on Space Sci. and Appl. of the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., No. 161, 14 Oct. 1980
(GPO-69-030) Avail: Subcommittee on Space Science and Applications

The necessity for accurate and timely detection of tornadoes is discussed. An interactive processing system, the Centralized Storm Information System (CSIS), is proposed. S.F.

N81-27756# Control Data Corp., Monterey, Calif.
SURVEY OF AVAILABLE SYSTEMS FOR IDENTIFYING SYSTEMATIC ERRORS IN NUMERICAL MODEL WEATHER FORECASTS Final Report
Patrick A. Harr and William D. Groscup Feb. 1981 98 p refs
(Contract N00228-79-C-X554)
(AD-A098848; NEPRF-CR-81-01) Avail: NTIS HC A05/MF A01 CSCL 12/1

A generalized and flexible software plane to identify systematic errors in numerical forecast models is described. The plan is applicable to different types of models and can be altered to operate in different modes. Examined are various techniques which can be used within the plan, in terms of advantages and disadvantages. Estimates are made of possible impacts upon an existing operational environment and of the useage of resources needed by a system for identifying systematic errors.
Author (GRA)

N81-27757# Arctic Inst. of North America, Arlington, Va.
INTERACTIONS WITHIN THE OCEAN-ICE-ATMOSPHERE SYSTEMS OF THE NORTH PACIFIC AND THE NORTH ATLANTIC
John E. Walsh (Illinois Univ., Urbana) and John E. Sater Feb. 1981 58 p refs Revised
(AD-A099681) Avail: NTIS HC A04/MF A01 CSCL 08/10

Four regional indices of sea ice variability and thirty years of monthly sea surface temperature (SST) and sea level pressure (SLP) data are used to evaluate the large-scale interactions within the ocean-ice-atmosphere systems of the North Pacific and the North Atlantic. A direct association between positive (negative) SST anomalies and light (heavy) ice in the Bering Sea is indicated. The SST/ice coupling in the northern Alaskan waters is also statistically significant. The SST anomalies in both the North Pacific and the North Atlantic appear as persistent responses to atmospheric forcing. The SLP distributions over both oceans correlate significantly with the arctic SLP distribution, although the midlatitude atmospheric circulation shows no systematic tendency to lead to lag the arctic circulation. Sea ice fluctuations correlate most highly with the atmospheric forcing over antecedent periods of approximately 9 months in the northern Alaskan waters, 3-4 months in the Bering Sea, and 5-7 months in the East Greenland Sea. The strength of the 9-month mean onshore air flow component describes over 70% of the northern Alaskan ice variance. Author (GRA)

N81-27758# Tel-Aviv Univ. (Israel). Dept. of Geophysics and Planetary Sciences.
DIRECT DETERMINATION OF WIND SHEARS FROM THE GRADIENTS OF SATELLITE RADIANCE OBSERVATIONS Final Technical Report, Jun. 1977 - Nov. 1980
George Ohring and Binyamin Neeman Nov. 1980 48 p refs
(Grant DA-ERO-77-G-051; DA Proj. 1T1-61102-GH-57)
(AD-A099890) Avail: NTIS HC A03/MF A01 CSCL 20/13

To the extent that the wind field is close to geostrophic, the thermal wind is a good approximation of the vertical wind shear (vertical variation of the horizontal wind). And since the thermal wind is proportional to the horizontal temperature gradient, the possibility exists of determining it from satellite radiance observations. Several different methods are developed for retrieving thermal winds directly from the horizontal gradients of satellite radiance observationsj The methods are applied to the determination of thermal winds in the upper troposphere and lower stratosphere over the White Sands Missile Range area. A special series of about 30 concurrent sets of radiance observations from the NOAA-4 VTPR instrument and wind shears from radiosonde observations, distributed throughout one year, is used for these tests. The results obtained with these direct methods are compared with results obtained with: (1) a traditional method, in which temperature profiles are first retrieved from the satellite radiances and the thermal winds are then obtained from the horizontal gradients of the retrieved temperatures, and (2) a linear regression between observed radiance gradients and observed wind shears. GRA

N81-27759# Manchester Univ. (England). Inst. of Science and Technology.
FIELD EXPERIMENTS ON THE OPTICAL, MICROPHYSICAL AND METEOROLOGICAL CHARACTERISTICS OF NATURAL FOGS AND CLOUDS Final Technical Report, Mar. 1979 - Jan. 1981

J. Latham and M. H. Smith Jan. 1981 56 p refs
(Contract DAJA37-79-C-0221; DA Proj. 1T1-61102-BH-57)
(AD-A099912) Avail: NTIS HC A04/MF A01 CSCL 04/1

The experimental program incorporates measurements of condensation nuclei concentrations and associated meteorological parameters made within the air feeding into clouds, as well as within such clouds. Instruments include modifications of Keily probe electrostatic disdrometers, PMS spectrometer probes, a Mee CCN counter and a PMS ASASP probe. A passive optical scattering instrument has also been used, in conjunction with a Barnes transmissometer operating at about 11.0 micrometers. Data for a variety of conditions and meteorological situations are presented. Theoretical work has included the development of an airflow model capable of predicting the microphysical properties of clouds over the summit of Great Dun Fell from a knowledge of the relevant parameters concerning the air parcels from which the clouds are formed. Computational studies have been made of the role of undersaturated air upon droplet size distributions. Author (GRA)

N81-27760# Weather Squadron (30th), San Francisco, Calif. 96307.
TERMINAL FORECAST REFERENCE NOTEBOOK, DETACHMENT 19, CAMP HUMPHREYS, AI, KOREA
30 Oct. 1980 39 p
(AD-A099666; AD-E850061; Rept-30WS/TFRN-81/001) Avail: NTIS HC A03/MF A01 CSCL 04/2

This publication describes the impact of weather at Camp Humphreys AI, Korea in terms of mission support requirements. Also included are the weather forecasting guidelines, which cover local topography, meteorological instrumentation, climatology, and predominant seasonal weather. GRA

N81-27761# Weather Wing (3rd), Offutt AFB, Nebr.
TERMINAL FORECAST REFERENCE NOTEBOOK, DETACHMENT 12, PLATTSBURG AFB, NEW YORK
1 Aug. 1980 52 p refs
(AD-A099663; AD-E850054; Rept-3WW/TFRN-80/001) Avail: NTIS HC A04/MF A01 CSCL 04/2

This publication provides weather forecasting guidelines for Plattsburg Air Force Base, New York. It covers the local topography, pollution sources, the meteorological instrumentation, climatology, and predominant seasonal weather regimes. Local forecast studies and forecasting rules of thumb are included. GRA

N81-27762# Weather Wing (2nd), APO New York. 09012
TERMINAL FORECAST REFERENCE NOTEBOOK FOR HELLENIKON AB, GREECE Final Report
14 May 1981 35 p
(AD-A099665; AD-E850060; Rept-2WW/TFRN-81/003) Avail: NTIS HC A03/MF A01 CSCL 04/2

This publication contains information on the topography and location of meteorological equipment on station, climatic aids, circulation, and associated seasonal synoptic patterns for Hellenikon AB, Greece. It was written as a aid to the local forecast situation and as a source of information for the station. GRA

N81-27763# Battelle Pacific Northwest Labs., Richland, Wash.
METEOROLOGICAL VALIDATION PROGRAM. CANDIDATE WIND TURBINE GENERATOR SITE SEMI-ANNUAL DATA SUMMARY FOR CULERRA, PUERTO RICO, JANUARY 1980 - JUNE 1980
Dec. 1980 14 p
(Contracts DE-AC06-76RL-01830; DE-AB01-77ET-20509)
(DOE/RL-01830/T5) Avail: NTIS HC A02/MF A01

Wind speed and direction data collected on meteorological towers at 13 candidate and wind turbine generator installation sites from January 1980 through June 1980 are summarized. The basic method of data collection is by digital data cassette recording systems. For the digital data reported, an instantaneous sample is recorded every 2 minutes. An explanation is provided for each data summary table as well as information on how specific values were computed. The annual summarized data for each site is included. DOE

N81-27764# Hawaii Univ., Honolulu. Dept. of Meteorology.
WIND ENERGY RESOURCE ATLAS. VOLUME 2: HAWAII AND PACIFIC ISLANDS REGIONS
T. A. Schroeder, A. M. Hori, D. L. Elliott, W. R. Barchet, and R. L. George Feb. 1981 127 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3195-WERA-11) Avail: NTIS HC A07/MF A01

Introductory and background information, and assessments of the wind resource in each division of the region is provided. Background on how the wind resource is assessed and on how the results of the assessment should be interpreted is presented. An introduction and outline to the descriptions of the wind resource for each division are also provided. Much of the information in the division chapters is given in graphic or tabular form. DOE

N81-27765# International Meteorological Inst., Stockholm (Sweden).
[ACTIVITIES IN METEOROLOGICAL RESEARCH] Annual Report, July 1979 - June 1980
Nov. 1980 35 p refs
Avail: NTIS HC A03/MF A01

Research activities, including international cooperation, are discussed with emphasis on dynamic meteorology, climatology and geophysical fluid dynamics. Chemical meteorology and biogeochemistry are also included. Work in atmospheric physics is discussed. Author (ESA)

N81-27766# World Meteorological Organization, Geneva (Switzerland).
THE GLOBAL WEATHER EXPERIMENT, 1978-1979
1980 49 p Original contains color illustrations Sponsored in part by U.N. Environment Program and U.N. Development Program
Avail: NTIS MF A01; Print copy available at WMO, Geneva

The motivation for the planning of and the observational requirements for the global weather experiment are discussed. The composite observing systems implemented for the experiment are detailed. The data management and the regional subprograms are also discussed. Organized by the world meteorological organization, the experiment was carried out in 1978-79 with the participation of 150 members to obtain a better understanding of the atmosphere and to assess the limit of predictability of weather systems. Author (ESA)

N81-27767# Fondazione Ugo Bordoni, Rome (Italy).
STATISTICAL PREDICTION METHODS FOR RAINFALL INTENSITY BASED ON HISTORICAL METEOROLOGICAL DATA [METODI DI PREVISIONE DELLE STATISCHE DELLA INTENSITA DI PRECIPITAZIONE PIOVOSA SULLA BASE DI SERIE STORICHE DI DATI METEOROLOGICI]
Francesco Barbaliscia, Francesco Fedi, and Walter Merenda Apr. 1979 24 p refs In ITALIAN
(FUB-46-1979) Avail: NTIS HC A02/MF A01

A prediction method, using one minute averaged rainfall intensity statistics derived from monthly averaged rainfall data, is presented. The method avoids high time resolution measurement of rainfall intensity in microwave attenuation analysis and system design. The Lenhard method was used in establishing the mathematical model correlating intensity probability to monthly averages. The meteorological data probability were taken from 5 Italian localities for 25 year period. Author (ESA)

N81-27768# National Oceanic and Atmospheric Administration, Boulder, Colo.
HAWAII MESOSCALE ENERGY AND CLIMATE PROJECT (HAMEC). 1: DATA USER'S GUIDE
G. Nolt, comp., E. C. Nickerson, comp., W. R. Caldwell, comp., M. Dias, comp., D. C. Welsh, comp., D. Bartels, comp. et al Nov. 1980 75 p refs
(PB81-164709; NOAA-81012913) Avail: NTIS HC A04/MF A01 CSCL 04B

Measurements obtained in the June 1980 field program of the Hawaii Mesoscale Energy and Climate Project (HAMEC) are summarized. The principal objectives in the design of this coordinated field study were: (1) measurements for initialization and testing of mesoscale numerical weather forecast models; (2) low level wind measurements; (3) carbon dioxide concentra-

tions; (4) chemical and acidity studies of the island and oceanic microphysics in the vicinity of the island of Hawaii. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N81-27769 British Library Lending Div., Boston Spa (England).
ASYMMETRICAL PELAGIC RANGES IN THE PACIFIC AND ATLANTIC OCEANS
R. Ya Margulis Nov. 1980 10 p refs Transl. into ENGLISH of Zool. Zh., v. 54, no. 10, 1975 p 1556-1559
(BLL-RTS-12432) Avail: British Library Lending Div., Boston Spa, England

Pelagic organisms in the ocean are distributed in such a way that one species takes over homologous habitats both north and south of the equator. The distributions of several species in the palagic zone of the Pacific and Atlantic ocean are presented. The basic habitats are characterized and the effects of ocean currents on species migration is discussed. T.M.

N81-27770 British Library Lending Div., Boston Spa (England).
GEOSTROPHIC CURRENTS OF THE NORTHEASTERN PART OF THE ATLANTIC
E. S. Erofeeva Nov. 1980 21 p refs Transl. into ENGLISH from Tr. Gos. Okeanogr. Inst. (USSR), no. 114, 1972 p 96-108
(BLL-RTS-12431) Avail: British Library Lending Div., Boston Spa, England

Data on the geostrophic currents, obtained from results of oceangraphic surveys carried out in the North Atlantic, are presented in discussion and map form. Calculations of the currents were based on hydrological data collected July to August of 1967 and 1968. S.F.

N81-27771# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
OCEANOGRAPHIC MANAGEMENT INFORMATION SYSTEM (OMIS): THE OCEANOGRAPHIC REQUIREMENTS DATABASE, DEVELOPMENT PHASE Final Report
S. Wasowski Mar. 1981 13 p refs
(AD-A098906; NORDA-TN-79) Avail: NTIS HC A02/MF A01 CSCL 08/10

The Navy's Oceanographic Requirements (NOR) relate to the oceanographic/environmental needs of Navy systems and fleet units in a wide variety of scientific and technological disciplines. The NOR database is a collection of information pertaining to the current needs expressed by the fleet or derived from system specifications. The objective of the database is to provide an information tool to management. Data elements include the scientific and technical parameters related to systems and requirements, priority and action agency. The same closed vocabulary keyword system used in the Navy Oceanographic Program (NOP) database is used to provide correlation between the datasets. This database has been turned over to the Naval Oceanographic Office, Information Systems Office, for operation as part of the overall Oceanographic Management Information System. Author (GRA)

N81-27772# Woods Hole Oceanographic Institution, Mass.
STRUCTURE AND DYNAMICS OF THE BENTHIC BOUNDARY LAYER ABOVE THE HATTERAS ABYSSAL PLAIN Ph.D. Thesis
Eric Arthur DAsaro May 1981 105 p refs
(Contract N00014-76-C-0197; Grant NSF OEC-76-81190; NR Proj. 0833-400)
(AD-A099137; WHOI-81-44) Avail: NTIS HC A06/MF A01 CSCL 08/3

The structure of the near-bottom velocity and density fields was observed for 3 months with a fixed velocity/temperature measuring array on the Hatteras Abyssal Plain. The velocity signal was examined for structure coherent with the observed mixed layers. Velocity fluctuations above 1 cph increase in energy near the bottom, especially within bottom mixed layers. The frequency and energy of these fluctuations is consistent with the expected properties of boundary layer turbulence. The turbulence as measured by these velocity fluctuations, is modulated on tidal and inertial time scales and extends intermittently throughout the bottom mixed layer. The clockwise near inertial velocity fluctuations, presumably due to internal waves, also show structure coherent with the observed mixed layers. Their energy decreases near the top of the mixed layer with little phase change. Within the mixed layer the phase begins to lead, with the phase increasing downward. The near inertial anticlockwise velocity fluctuations show far less coherence with the mixed layer structure; higher frequency internal wave band velocity fluctuations show very little coherence with the mixed layer structure. The characteristic boundary layer velocity signal in both the high frequency and near inertial bands commonly extends throughout the mixed layer, often significantly above the estimated turbulent Ekman layer height. These observations are inconsistent with a steady turbulent Ekman layer model of the boundary layer. Author (GRA)

N81-27773# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
DESCRIBING OCEAN PHENOMENA USING COHERENT RADARS. PROCEEDINGS OF A NORDA WORKSHOP Final Report
R. L. Zalkan and L. B. Wetzel May 1981 69 p refs Conf. held at Bay St. Louis, Miss., 13-15 Nov. 1979
(AD-A099596; NORDA-TN-104) Avail: NTIS HC A04/MF A01 CSCL 08/3

The Naval Ocean Research and Development Activity inaugurated a series of oceanographic workshops during the fall of 1979 covering various topics in ocean science and technology. These workshops were sponsored by the Chief of Naval Research. On 13-15 November 1979, a workshop entitled 'Describing Ocean Phenomena Using Coherent Radars' was held at NSTL Station, Miss. Leading workers in both hydrodynamics and electromagnetic scattering came together to discuss the status of relevant scattering theories, the kinds and reliability of data obtained with different sensor systems, and the hydrodynamics information extractable from these data. In the material contained within this technical note, the invited talks and plenary session are summarized along with the presentation of the reports of the working groups. During the interval between the conclusion of the workshop and the publication of these proceedings, many papers that were in preparation or had been submitted to journals subsequently appeared in print. For completeness, these later references have been cited. A sample of the give-and-take interplay that occurred throughout the workshop may be found in the Open Discussion at the end of this report. Author (GRA)

N81-27774# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
PRELIMINARY DEVELOPMENT OF A MEASURING NETWORK FOR THE NORTH SEA AND BALTIC (VEMNO 1 AND 2). EXPERIMENTAL INVESTIGATIONS, DEVELOPMENT AND TEST OF EQUIPMENT FOR AUTOMATIC MEASURING STATIONS AT SEA WITH DATA TRANSMISSION Final Report
Hartmut Schulze (Gesellschaft fuer Kernernergieverwertung in Schiffbau und Schiffahrt m.b.H.) and Siegfried Govaers Bonn Dec. 1980 94 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-M-80-003; ISSN-0340-8868; BMFT-MTK-0013; BMFT-MTK-0021) Avail: NTIS HC A05/MF A01

The stepwise installation of a measuring network in the North Sea and Baltic Sea is described. The network consists of automatically operated stations with UHF data transmission due to the possible use of satellites. The network provides longterm synoptic sampling of oceanographic and meteorological data over wide sea areas. Following the requirements of potential users, development priorities are described for automatically operated complete measuring and telemetering systems, characterized by high reliability and long-term accuracy. Special components and subsystems of highest importance, regarding these user requirements, are described. Air temperature and pressure, wind velocity and direction, air humidity, water temperature and pressure, conductivity, etc., are among the main physical parameters emphasized. Author (ESA)

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N81-27775 Fordham Univ., New York, N. Y.
CONCENTRATION OF SELECTED TRACE METALS BY MARINE PHYTOPLANKTON Ph.D. Thesis
Arthur V. Stiffey 1981 151 p
Avail: Univ. Microfilms Order No. 8111320

Cultures of Platymonas subcordiformas, Nitzschia closterum and Dunaliella sp. grown in a chemically defined artificial sea water medium were exposed to two levels of cadmium, iron, lead and nickel for periods of 2, 8, 16 and 48 hours. Metals were determined by flameless atomic absorption spectrophotometry. Cadmium uptake was low with all genera tested. Iron uptake was rapid and almost complete within 8 hours. Lead uptake was rapid and reached maximum uptake at 8 hours diminishing at 48 hours. Nickel uptake was quite low with all genera tested. Dissert. Abstr.

N81-27776 British Library Lending Div., Boston Spa (England).
INSTRUMENTAL ASSESSMENT OF SHARPNESS OF OUTLINE OF ZONES OF INHIBITION OF GROWTH OF TEST MICROORGANISMS DURING DIFFUSION OF ANTIBIOTICS IN INFECTED AGAR
E. M. Bershtein Feb. 1981 11 p refs Transl. into ENGLISH of Antibiotika (Moscow), v. 23, no. 12, 1978 p 1088-1094 (BLL-RTS-12497) Avail: British Library Lending Div., Boston Spa, England

The optimization of the IFO-451 recording microphotometer, which measures optical densities of transparent objects, in the study of zone of growth inhibitation and edge sharpness was assessed. The agar layer was placed on the stage of the microphotometer and the growth inhibition zone was located. Microphotometers can be used to obtain objective quantitation evaluation zones of inhibition and their boundaries. The characteristics are applicable as response functions when analytical methods are optimized by experimental mathematical methods. It was found that in antibiotic analysis by diffusion method, the changes in conditions of cultures have a significant effect on the obtained values. E.A.K.

N81-27777 British Library Lending Div., Boston Spa (England).
PELAGIC GAMMARIDS OF THE TROPICAL PART OF THE PACIFIC OCEAN
Ya. A. Birshtein and M. E. Vinogradov Mar. 1981 7 p Transl. into ENGLISH of Tr. Inst. Okeanol. Akad. Nauk SSSR, v. 34, 1960 p 220-223
(BLL-RTS-12449A) Avail: British Library Lending Div., Boston Spa, England

Physical descriptions of two specimens of the family Eusiridae, genus Eusirus Kroyer, are given. A 17 mm long specimen of Eusirus bathybius Schellenberg found in the Bougainville trench, and a 10 mm long specimen of Eusirus fragilis Birshtein and M. Vinogradov, sp. n., found in the Tonga trench are described. Drawings of body parts are presented. J.D.H.

N81-27778*# Utah Univ., Salt Lake City. Dept. of Psychology.
TO DEVELOP BEHAVIORAL TESTS OF VESTIBULAR FUNCTIONING IN THE WISTAR RAT Final Report, Dec. 1978 - Nov. 1980
Harold C. Nielson Nov. 1980 26 p refs
(Grant NsG-2350)
(NASA-CR-164537) Avail: NTIS HC A03/MF A01 CSCL 06C

Two tests of vestibular functioning in the rat were developed. The first test was the water maze. In the water maze the rat does not have the normal proprioceptive feedback from its limbs to help it maintain its orientation, and must rely primarily on the sensory input from its visual and vestibular systems. By altering lighting conditions and visual cues the vestibular functioning without visual cues was assessed. Whether there was visual compensation for some vestibular dysfunction was determined. The second test measured vestibular functioning of the rat's behavior on a parallel swing. In this test the rat's postural adjustments while swinging on the swing with the otoliths being stimulated were assessed. Less success was achieved in developing the parallel swing as a test of vestibular functioning than with the water maze. The major problem was incorrect initial assumptions of what the rat's probable behavior on the parallel swing would be. S.F.

N81-27779*# National Aeronautics and Space Administration, Washington, D. C.
THE NATURE OF COMPENSATORY AND RESTORATIVE PROCESSES IN THE LIVERS OF ANIMALS IRRADIATED DURING HYPOKINESIA
I. P. Chernov and L. V. Trusova Jul. 1981 11 p refs Transl. into ENGLISH from Med. Radiol. (USSR), v. 24, no. 4, Apr. 1979 p 42-47 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original language doc. prep. by Paylov Medical Inst., Ryazan (USSR)
(Contract NASw-3199)
(NASA-TM-76513) Copyright. HC A02/MF A01 CSCL 06R

The nature of postirradiation repair in the livers of rats irradiated during hypokinesia is investigated. Hepatocyte population counts, mitotic activity, binuclear cell content, and karyometric studies were done to ascertain the effects of combined hypokinesia and radiation. Hypokinesia is shown to change the nature and rate of post-irradiation changes in the liver, the effect varying with the timing of irradiation relative to the length of hypokinesia. It is concluded that the changes in the compensatory and restorative processes are caused by stress developed in response to isolation and restricted mobility. By changing neuroendocrine system activity, the stress stimulates cell and tissue repair mechanisms at a certain stage essential to the body's reaction of subsequent irradiation. J.D.H.

N81-27780*# National Aeronautics and Space Administration, Washington, D. C.
REACTION BY THE RAT HYPOTHALAMUS-HYPOPHYSEAL SYSTEM TO STRESS FROM IMMOBILIZATION
B. Gajkowska, A. Luciani, and J. Borowicz Jul. 1981 25 p refs Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Polish Academy of Sciences
(Contract NASw-3199)
(NASA-TM-76514) Avail: NTIS HC A02/MF A01 CSCL 06S

Cytophysical changes in the ultrastructure of the neurosecretory hypothalamus under conditions of total short term immobility and partial long term immobility are investigated. Electron microscope morphological studies revealed a stimulatory response of the hypothalamus hypophyseal system of the rat brain to stress produced by immobilization. Total immobilization for two days resulted in changes in the neurons of the supraoptical and paraventricular nuclei and in the fibers of the neurohypophysis indicating an increased production of neurosecretory granules, their rapid flow and enhanced secretion to the blood. Partial immobilization of the animals for 3 weeks produced changes of a somewhat different character and of weaker intensity, which may be considered as a manifestation of the adaptation of the system and of the whole organism to the changed condition. J.D.H.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N81-27781* National Aeronautics and Space Administration, Washington, D. C.
STUDY OF CATECHOLAMINE EXCRETION DURING VIBRATION SICKNESS
K. Nedelcheva, V. Kirkov, I. Khadzhiyeva, and R. Trendafilova Feb. 1981 9 p refs Transl. into ENGLISH from Gig. Tr. Prof. Zabol. (USSR), no. 3, 1976 p 49-51 Transl. by Scientific Translations Service, Santa Barbara, Calif. Original doc. prep. by Inst. of Transportation Medicine, Center of Hygiene, (Sofia)
(Contract NASw-3198)
(NASA-TM-76548) Copyright. Avail: Issuing Activity CSCL 06S

The secretion of catecholamines (CA) during vibration sickness

was studied in ore miners. The quantity of excreted CA in daily urine was studied by spectrofluorometry for epinephrine (A), norepinephrine (NA), Dopamine (DA). An increase in excreted A, NA, and DA was observed. The increase of CA excretion and links of CA metabolism and the increase in the reserve potentialities of the sympathetic system was noted. Vibration sickness caused by local vibration increased the activity of the sympathetic adrenal system. It is suggested that the excretion of A, NA, DA should be considered in determining the degree of vibration sickness. E.A.K.

N81-27782 Texas Woman's Univ., Denton.
THE INFLUENCE OF PHYSICAL CONDITIONING AND DECONDITIONING UPON CARDIAC STRUCTURE OF MALES AND FEMALES Ph.D. Thesis
Abdul-Rahman Saleh Al-Muhailani 1980 192 p
Avail: Univ. Microfilms Order No. 8110509

The influence of 10 week conditioning and deconditioning programs upon the cardiac structures of 20 college students was measured by echocardiography. A two-way analysis of variance with repeated measures revealed that treadmill performance time (TPT), IVS thickness, PWT, LVIDd, LVIDs, LVID3, LVIDs3, and SV significantly increased following conditioning, then significantly decreased following deconditioning programs. The data also showed that the male Ss had greater heart walls and dimensions when compared to the female values.
Dissert. Abstr.

N81-27783* National Aeronautics and Space Administration. Pasadena Office, Calif.
MEDICAL DIAGNOSIS SYSTEM AND METHOD WITH MULTISPECTRAL IMAGING Patent
Victor J. Anselmo (JPL, California Inst. of Technology, Pasadena) and Terrence H. Reilly, inventors (to NASA) (JPL, California Inst. of Technology, Pasadena) Issued 16 Oct. 1979 10 p Filed 28 Nov. 1977 Sponsored by NASA
(NASA-Case-NPO-14402-1; US-Patent-4,170,987; US-Patent-Appl-SN-855364; US-Patent-Class-128-665; US-Patent-Class-356-407; US-Patent-Class-356-406; US-Patent-Class-356-416) Avail: US Patent and Trademark Office CSCL 06B

A skin diagnosis system includes a scanning and optical arrangement whereby light reflected from each incremental area (pixel) of the skin is directed simultaneously to three separate light filters, e.g., IR, red, and green. As a result, the three devices simultaneously produce three signals which are directly related to the reflectance of light of different wavelengths from the corresponding pixel. These three signals for each pixel after processing are used as inputs to one or more output devices to produce a visual color display and/or a hard copy color print, for one usable as a diagnostic aid by a physician.
Official Gazette of the U.S. Patent and Trademark Office

N81-27784 British Library Lending Div., Boston Spa (England). Article Translating Service.
A RESPIRATION APPARATUS FOR THE CLINICAL DETERMINATION OF THE ENERGY TURNOVER IN MAN
A. Krogh Jan. 1981 17 p refs Transl. into ENGLISH from Weiner Klin. Wochenschr. (West Germany), no. 35, no. 13, 1922 p 290-293
(BLL-RTS-12030) Avail: British Library Lending Div., Boston Spa, England

A device which does not require gas analysis to determine energy turnover in humans was designed. The apparatus controls whether oxygen uptake remains constant throughout the test period. The device consists of a recording spirometer which provides a graphic respiration recording with an aluminum bell. An absorption container for carbon dioxide filed with wet, coarse grained, soda lime, is built into the spirometer. It is shown that oxygen consumption can be determined under this procedure and is comparable to gas analytical methods. E.A.K.

N81-27785*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TOTAL HIP JOINT REPLACEMENT BIOTELEMETRY SYSTEM
J. F. Boreham, R. B. Postal, and R. A. Luntz 1 May 1981 76 p refs
(Contract NAS7-100)
(NASA-CR-164529; JPL-Pub-80-98) Avail: NTIS HC A05/MF A01 CSCL 06B

The development of a biotelemetry system that is hermetically sealed within a total hip replacement implant is reported. The telemetry system transmits six channels of stress data to reconstruct the major forces acting on the neck of the prosthesis and uses an induction power coupling technique to eliminate the need for internal batteries. The activities associated with the telemetry microminiaturization, data recovery console, hardware fabrications, power induction systems, electrical and mechanical testing and hermetic sealing test results are discussed. E.A.K.

N81-27786*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ION BEAM SPUTTER-ETCHED VENTRICULAR CATHETER FOR HYDROCEPHALUS SHUNT Patent Application
Bruce Banks, inventor (to NASA) Filed 10 Jun. 1981 11 p (NASA-Case-LEW-13107-1; US-Patent-Appl-SN-272407) Avail: NTIS HC A02/MF A01 CSCL 06B

A cerebrospinal fluid shunt in the form of a ventricular catheter for controlling the condition of hydrocephalus by relieving the excessive cerebrospinal fluid pressure is described. A method for fabrication of the catheter and shunting the cerebral fluid from the cerebral ventricles to other areas of the body is also considered. Shunt flow failure occurs if the ventricle collapses due to improper valve function causing overdrainage. The ventricular catheter comprises a multiplicity of inlet microtubules. Each microtubule has both a large openings at its inlet end and a multiplicity of microscopic openings along its lateral surfaces. The microtubules are perforated by an ion beam sputter etch technique. The holes are etched in microtubule by directing sn ion beam through an electro formed metal mesh mask producing perforations. NASA

N81-27787*# National Aeronautics and Space Administration, Washington, D. C.
THE NEGATIVE EFFECT OF HYPOKINESIA INVOLVING INJURY AND PREVENTIVE MEASURES
Kh. A. Izakson Apr. 1981 4 p Transl. into ENGLISH of "Otritsatelnoye vliyaniye gipokinezii v svyazi s travmoy i Mery Profilaktiki", Tallin, Voprosy Kurotolgii, Fizioterapii I Lechebnoy Fizicheskoy Kultury, No. 4, 1978 p 81 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76562) Avail: NTIS HC A02/MF A01 CSCL 06P

The optimum length of bed rest for athletes suffering from broken bones is considered. Negative effects of hypokinesia induced by bed rest include general weakness and deconditioning of the muscles as well as sleeplessness, headaches, muscle pain, constipation, unstable pulse and arterial pressure, and changes in reflexes. This is considered to be the result of a vegetative dysfunction induced by the decreased flow of nerve impulses and a decrease in interoceptive and exteroceptive signals. The briefest possible period of bed rest, followed by an increase in motor activity, the prescription of a large quantity of LFK, and an active program of physical therapy are recommended. The symptomology associated with hypokinesia disappears after one month of free motor activity. J.D.H.

N81-27788# Office of Technology Assessment, Washington, D. C.
ASSESSMENT OF TECHNOLOGIES FOR DETERMINING CANCER RISKS FROM THE ENVIRONMENT
Jun. 1981 248 p refs
Avail: NTIS HC A11/MF A01

Exposures and behaviors related to cancer occurrence, a first step in cancer prevention, are examined. The importance of environmental factors in cancer occurrence, the laws that require actions to reduce exposures to cancer causing substances (carcinogens) were studied. The following topics are discussed: what is known about the occurrence of cancer and death from cancer in the United States; methods to identify cancer causing substances, exposures, and behaviors; methods to estimate the amount of cancer which may result from a particular behavior

of exposure: Federal laws that provide for regulatory control of carcinogenic exposures; and, options for Congress. E.A.K.

N81-27789# Argonne National Lab., Ill.
HEALTH EFFECTS OF SYNFUELS TECHNOLOGY: A REVIEW
L. P. Sanathanan, C. A. Reilly, S. A. Marshall, and K. E. Wilzbach Apr. 1981 65 p refs
(Contract W-31-109-eng-38)
(ANL/ES-111) Avail: NTIS HC A04/MF A01

Annotated synopses of information pertinent to health impacts of synthetic fuel technologies under development are presented. The focus is on carcinogenesis, which appears to be a special problem with coal conversion technologies. This review is intended to serve as a reference for the NEPA Affairs Division of DOE in its evaluation of the overall synthetic fuel program and specific projects in the program. DOE

N81-27790# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
THRESHOLDS FOR THE VISUAL PERCEPTION OF POSITION DEVIATIONS AND MOTION
J. Smit 24 Nov. 1978 16 p refs
(Contract NIVR-1857)
(NLR-TR-79025-U) Avail: NTIS HC A02/MF A01

The accuracy with which some relevant display elements are set during a visual approach to landing at a desired, nominal, position was determined in an experiment via the phychophysical method of adjustment. Subjects were required to perform a number of visual positioning tasks while viewing a scene representing a position (200 ft on a 3 deg glide scope) during a landing. Mean settings, means and standard deviations of the adjustment errors and root mean square values for the various configurations were obtained. Author (ESA)

N81-27791# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
TOXIC HAZARDS IN AVIATION
Apr. 1981 131 p refs In ENGLISH and FRENCH Proc. of conf. held in Toronto, 15-19 Sep. 1980
(AGARD-CP-309; ISBN-92-835-0291-4) Avail: NTIS HC A07/MF A01

The aviation environment contains many toxic materials and products. With the evolution of more advanced aircraft propulsion mechanisms, specialized aircraft material development and associated maintenance activities, there is a major increase in the potential toxic hazards associated with these systems. The threat of toxic exposure covers the entire spectrum of low-level continuous or intermittent to high-level brief accidental or unavoidable exposures. However, the protection of the crew and passengers is not the only concern in dealing with the toxic hazards in aviation. Research in the biomedical aspects of occupational health and safety standards, toxic substances, environmental impact criteria and classification of transportation is highlighted. For individual titles, see N81-27792 through N81-27805.

N81-27792# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Toxic Hazards Div.
RAMJET FUEL TOXICOLOGY
Kenneth C. Back *In* AGARD Toxic Hazards in Aviation Apr. 1981 6 p refs (For primary document see N81-27791 18-52)
Avail: NTIS HC A07/MF A01

Fuels containing isomers of perhydromethylcyclopentadiene (RJ4), reduced dimers of bicyclohepadiene (RJ5), a tricyclodecane compound (JP10) and methylcyclohexane were studied for their acute, subacute, and chronic toxicity. The agents are of low order toxicity from acute exposure. Chronic toxicity studies were run on RJ4, and JP10 using rats, mice, dogs and monkeys. Kidney and liver hyperplasia in RJ4 exposed rats and pulmonary irritation in dogs and monkeys exposed to RJ4 and RJ5 emerge as the salient results. Although there is some indication of increased tumor incidence in a small number of mice held for one year after exposure to near saturated RJ5 vapors, there is no clear cut evidence that this compound is carcinogenic. T.M.

N81-27793# Naval Medical Research Inst., Wright-Patterson AFB, Ohio. Toxicology Detachment.
THE TOXICITY OF GRADE JP-5 AVIATION TURBINE FUEL, A COMPARISON BETWEEN PETROLEUM AND SHALE-DERIVED FUELS
Morris J. Cowan, Jr. and Lawrence J. Jenkins, Jr. (Shell Development Co., Houston, Tex.) *In* AGARD Toxic Hazards in Aviation Apr. 1981 7 p refs (For primary document see N81-27791 18-52)
Avail: NTIS HC A07/MF A01

In order to assess the suitability of shale-derived JP-5, it is important that its inherent toxicity be identified and that the comparative toxicity of both the shale and petroleum JP-5 be identified. As a liquid acute spill hazard the fuels were examined for ocular and dermal irritation potential and for skin sensitization potential. Since the fuel is a complex mixture of aliphatic and aromatic hydrocarbons each exhibiting different vapor pressures, the nature of any accidental inhalation exposure will be dependent on the concentration of low boiling components in the mixture. The fuels were examined as a vapor inhalation hazard by exposing animals continuously for 90 days to vapors as high as 750 mg/cu m. Groups of animals were examined at 90 days and at the end of their normal expected lifetime. The fuels were examined as a potential oncogen by histopathologic examination of the animals exposed for 90 days and held for a lifetime. T.M.

N81-27794# Ohio State Univ., Columbus. Dept. of Veterinary Pathology.
DIFFERENTIAL EFFECTS OF HYDRAZINE COMPOUNDS ON B- AND T-CELL IMMUNE FUNCTION
Melinda J. Tarr and Richard G. Olsen *In* AGARD Toxic Hazards in Aviation Apr. 1981 7 p refs (For primary document see N81-27791 18-52)
(Contract F49620-79-C-0163)
Avail: NTIS HC A07/MF A01

The immunotoxic effects of four hydrazine compounds were evaluated by adding them to lymphocytes in the lymphocyte blast transformation (LBT) assay. 1,1-dimethylhydrazine (UDMH) caused an enhancement of the LBT response of murine splenocytes to the B-cell mitogen lipopolysaccharide (LPS) at concentrations of 10-25 ppm. 1,2-dimethylhydrazine (SDMH) exerted an effect similar to that of UDMH when added to splenocytes in the LBT assay, causing an enhancement of the LBT response to LPS at low concentrations, then a suppression at higher concentrations. The results suggest that UDMH and SDMH abrogate suppressor cell function, and that Hz and MMH suppress T-cell function (cell-mediated immunity) more than B-cell function (humoral immunity). T.M.

N81-27795# California Univ., Irvine. Dept. of Developmental and Cell Biology.
HYDRAZINE EFFECTS ON VERTEBRATE CELLS IN VITRO
Ann E. Siemens, Margarita C. Kitzes, and Michael W. Berns *In* AGARD Toxic Hazards in Aviation Apr. 1981 16 p refs Submitted for publication (For primary document see N81-27791 18-52)
(Contract AF-AFOSR-3136-77)
Avail: NTIS HC A07/MF A01

Cells were exposed to hydrazine in various concentrations (0.001 mM to 10 mM) for varying time periods. The resulting growth and morphological data revealed a possible site of hydrazine action. In all cell lines tested, population growth was depressed by low concentration of hydrazine (0.01 mM to 0.1 nM). Cell growth was initially depressed, but it eventually returned to normal log phase growth even when fresh hydrazine was added to the culture medium. At higher concentrations (0.5 mM to 2.0 mM), hydrazine was lethal. Most cell types first showed population growth depression at 0.01 mM hydrazine, but the lethal concentration varied with the cell type. Cultures treated with hydrazine yielded a significantly higher number of giant, multinucleated cells. Autoradiography studies confirmed that the large, multinucleated cells resulted from cell fusion.T.M.

N81-27796# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Toxic Hazards Div.
THE ONCOGENIC HAZARD FROM CHRONIC INHALATION OF HYDRAZINE
Vernon L. Carter, Jr., Kenneth C. Back, and James D. MacEwen (California Univ., Irvine) *In* AGARD Toxic Hazards in Aviation

Apr. 1981 9 p refs (For primary document see N81-27791 18-52)
Avail: NTIS HC A07/MF A01

Studies were therefore conducted to evaluate the long term effects of airborne hydrazine at levels near the present and proposed Threshold Limit Value concentrations. Repeated daily inhalation exposure to 5 parts per million (ppm) hydrazine induced nasal tumors in Fischer 344 male and female rats and in male Golden Syrian hamsters. Repeated exposure to 1 ppm also produced nasal turbinate tumors in rats and pulmonary adenomas in female C57B1/6 mice. The inhalation exposures to the rodents were conducted for 6 hours per day, 5 days per week over a 12 month period. Rats and mice were held 18 months postexposure. The nasal turbinate tumor incidence in rats was dose related. No statistically significant tumorigenic effects occurred after repeated exposure to 0.05 and 0.25 ppm hydrazine concentrations which spanned the American Conference of Governmental Industrial Hygienists recommended Threshold Limit Value. T.M.

N81-27797# Ohio State Univ., Columbus. Dept. of Veterinary Pathobiology.
INHIBITION OF VIRUS TRANSFORMATION BY HIGH ENERGY FUELS AS A CORRELATE OF CARINOGENIC POTENTIAL
James R. Blakeslee, Jr. *In* AGARD Toxic Hazards in Aviation Apr. 1981 6 p refs (For primary document see N81-27791 18-52)
(Contracts F49620-77-C-0110; F49620-C-0087)
Avail: NTIS HC A07/MF A01

Hydrazine and naphthylamines and their derivatives were assayed for co-carcinogenic effects on ST FeSV-directed transformation of human cells. All chemicals tested at non-toxic concentrations showed anti-carcinogenic activity. The temporal relationship of chemical treatment to virus infection was more critical with the hydrazines than with the naphthylamines in that maximum anti-carcinogenic effect occurred when virus-infected cells were exposed to the hydrazines 2 hrs. post-infection, whereas the naphthylamines anti-carcinogenic effect was observed if cells were exposed either pre- or post-infection. The anti-carcinogenic effect, when compared with in vitro chemical transformation and neoplastic transformation, show a high degree of correlation. These data suggest this assay system may lend itself to a rapid screen (9-13 days) of chemicals for carcinogenic potential. Cytotoxic results showed no significant difference in shale oil or petroleum derived JP5 or DFM. Author

N81-27798# Ohio State Univ., Columbus. Dept. of Physiological Chemistry.
INTERTISSUE VARIATION IN BENZO(A)PYRENE METABOLISM BY HUMAN SKIN, LUNG AND LIVER IN VITRO
George E. Milo, Ronald W. Trewyn, Raman Tejwani, James W. Oldham, and William H. J. Douglas (Tufts Univ., Boston) *In* AGARD Toxic Hazards in Aviation Apr. 1981 9 p refs (For primary document see N81-27791 18-52)
(Contract F49620-77-C-0110)
Avail: NTIS HC A07/MF A01

Benzo(a)pyrene (B(a)P), an environmental carcinogen, is shown to transform human skin fibroblasts in vitro. This fossil fuel combustion product and other polynuclear hydrocarbons have exhibited a requirement to be biotransformed to their ultimate carcinogenic forms to induce transformation. B(a)P diol-epoxides are the most cited candidates as ultimate carcinogens. Results suggest that either the ultimate form of the carcinogen is different for fibroblasts and epithelial cells or the quantitative generation of hydroxylated metabolites is not required for neoplastic transformation in fibroblast cells. If hydroxylation is required, then the site of hydroxylation may be the significant factor. Present evidence suggests that in B(a)P treated fibroblasts the activation of B(a)P in the cell takes place other than the microsomal P450 complex, presumably in the nucleus. T.M.

N81-27799# Laboratoire Central de Biologie Aerospatiale, Paris (France). Div. de Chimie-Toxicologie.
THE TOXICITY OF GASES FROM THE THERMAL DECOMPOSITION OF COMBUSTIBLE MATERIALS. A TEST CHAMBER PROTOTYPE [TOXICITE DES GAZ DE DECOMPOSITION THERMIQUE DES MATIERES COMBUSTIBLES]
P. E. Picart, J. P. Delcroix, and M. Guerbet *In* AGARD Toxic Hazards in Aviation Apr. 1981 10 p refs In FRENCH (For primary document see N81-27791 18-52)
Avail: NTIS HC A07/MF A01

When fire breaks out in a closed environment, as in an aircraft cabin, evacuation is not immediately possible and thus it is necessary to establish minimum survivable conditions. In this case, toxic gases become a major problem. That is why it is necessary to select materials that present a minimum of toxicity in case of an onboard fire. A test chamber was developed that permits the examination of physical parameters involved with the thermal degradation of aircraft materials, with emphasis on the toxicity of combustion gases. The test chamber is described and the results of tests run on three materials (wood, polyurethane resins, polyvinyl chloride) are presented. T.M.

N81-27800# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
ACUTE CARBON MONOXIDE POISONING
H. D. Madill and B. J. Gill *In* AGARD Toxic Hazards in Aviation Apr. 1981 5 p refs (For primary document see N81-27791 18-52)
Avail: NTIS HC A07/MF A01

The principal toxic action of carbon monoxide is accepted as being due to its combination with hemoglobin to form carboxyhemoglobin (COHb). This has the effect of diminishing the oxygen carrying capability of the blood as well as altering the oxygen dissociation characteristics of the remaining oxyhemoglobin. This fundamental action of carbon monoxide was utilized as an objective measure of the degree of exposure and resulting intoxication based upon the level of COHb produced. The relationship between variable physiological parameters such as diffusivity of the lung, the ventilation rate and the affinity of blood for CO, the CO concentration in inspired air and the exposure time provides a means of predicting COHb formation. T.M.

N81-27801# Laboratoire de Medecine Aerospatiale, Bretigny-sur-Orge (France).
THE INFLUENCE OF ALTITUDE ON THE TOXICITY OF CARBON OXIDES [INFLUENCE DE L'ALTITUDE SUR LA TOXICITE DES OXYDES DE CARBONE]
H. Vieillefond, J. L. Poirer, and H. Marotte *In* AGARD Toxic Hazards in Aviation Apr. 1981 4 p refs In FRENCH (For primary document see N81-27791 18-52)
Avail: NTIS HC A07/MF A01

The effects of the reduction of partial oxygen pressure on the toxicity of a mixture of carbon dioxide and carbon monoxide were examined. The degradation of psychomotor performance along with cardiovascular reactions were studied. Standards were established for carbon monoxide concentrations. T.M.

N81-27802# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
IN-FLIGHT OXYGEN GENERATING EQUIPMENT
John P. Allen *In* AGARD Toxic Hazards in Aviation Apr. 1981 12 p refs (For primary document see N81-27791 18-52)
Avail: NTIS HC A07/MF A01

On-board systems produce high oxygen concentrations of physiologically adequate oxygen for the aircrews. The quality of the oxygen is dependent on the quality of the input air and the provisions made for contaminant control. The molecular sieve material provides up to 95% oxygen with contaminant removal and separation from the oxygen product gas mixture. The chlorate candle oxygen generator produces almost 100% oxygen for 30 minutes and has effective adsorbers to remove contaminants from the oxygen produced. The fluomine system provides up to 98% oxygen in the product gas and uses activated carbon and molecular sieve filters for contaminant control. The concept with the greatest potential is the molecular sieve system using a specific type of sieve materials for oxygen concentration and effective contaminant control. Description of the systems are presented. T.M.

N81-27803# School of Aerospace Medicine, Brooks AFB, Tex.
MOLECULAR SIEVE OXYGEN GENERATION SYSTEM: CONTAMINANT STUDIES
K. G. Ikels and J. Ernsting *In* AGARD Toxic Hazards in Aviation Apr. 1981 7 p refs (For primary document see N81-27791 18-52)

Avail: NTIS HC A07/MF A01

The concept of inflight generation of breathing gas is attractive for military aircraft from the standpoint of logistics; safety, and cost. Evaluation and physiological assessment of the molecular sieve system in the laboratory is generally conducted with clean compressed air. In aircraft, however, the molecular sieve generator is supplied with engine bleed air which may not always be totally free of contaminants. Laboratory studies demonstrated that low molecular weight compounds pass through a molecular sieve bed into the breathing gas. The concentrations of the contaminants appearing in the output breathing gas are, however, much lower than that in the supply air and are shown to be directly related to the output demand flow of the oxygen generator. T.M.

N81-27804# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).

AIRSCAN: AN ULTRASENSITIVE TRACE AIR IMPURITY ANALYZER FOR USE IN TOXIC AVIATION ENVIRONMENTS

R. Leveson, N. Barker, L. Kuehn, and H. D. Madill *In* AGARD Toxic Hazards in Aviation Apr. 1981 12 p refs Prepared in cooperation with Photovac, Inc., Thornhill, Ontario (For primary document see N81-27791 18-52)

Avail: NTIS HC A07/MF A01

An advanced air analyzer is described that is capable of detecting a wide range of pollutants in ambient air at concentrations of well below 1 part-per-billion. The system employs a combination of photoionization detection with gas chromatography using air as the carrier gas, it is fully field portable and accepts a directly introduced sample of air without any need for time-consuming preconcentration procedures. Applications for the instrument include the monitoring of all manner of environments including those within aircraft and spacecraft as well as external environments which may be contaminated during fuelling operations or by accidental emissions from specialized ordinanced. Hydrazine is of particular current relevance. Further applications include the monitoring of human exhaled breath in cases where there has been an unquantified exposure to toxic compounds. Such exposures are difficult to monitor at low levels; however the extreme sensitivity of the system makes it possible to detect breath metabolites in extremely concentrations. T.M.

N81-27805# Rouen Univ. (France). Lab. de Toxicologie.

A LABORATORY MODEL FOR THE EVALUATION OF THE TOXICITY OF COMBUSTION PRODUCTS [MODELE DE LABORATOIRE POUR EVALUER LA TOXICITE DES PRODUITS DE COMBUSTION]

J. M. Jouany, J. M. Presles (DRET, Paris), and J. Pre (Paris XIII Univ., Bobigny) *In* AGARD Toxic Hazards in Aviation Apr. 1981 14 p refs In FRENCH (For primary document see N81-27791 18-52)

Avail: NTIS HC A07/MF A01

Criteria are established for the selection of aircraft compartment materials. The toxicity of the materials after undergoing thermal degradation was examined. A screening method is described which compares different biological effects with emphasis on respiration and oxygen metabolism. An index was developed to classify the materials. T.M.

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

No abstracts in this category.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N81-27806* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

HELMET WEIGHT SIMULATOR Patent

Billy R. Ashworth, Alton C. Hall, and Clyde E. Clark, inventors (to NASA) Issued 28 Apr. 1981 4 p Filed 30 May 1979 Supersedes N79-25761 (17 - 16, p 2179)

(NASA-Case-LAR-12320-1; US-Patent-4,264,310; US-Patent-Appl-SN-043913; US-Patent-Class-434-59) Avail: US Patent and Trademark Office CSCL 05H

A device for providing acceleration cues to the helmet of a simulator pilot is described. Pulleys are attached to both shoulders of the pilot. A cable is attached to both sides of the helmet and extends through the pulleys to a takeup reel that is controlled by a torque motor. Control signals are applied to a servo system including the torque motor, the takeup reel and a force transducer which supplies the feedback signal. In one embodiment of the invention the force transducer is in the cable and in another it is in the takeup reel.

Official Gazette of the U.S. Patent and Trademark Office

N81-27807* National Aeronautics and Space Administration, Washington, D. C.

INVESTIGATION OF ACTUAL NUTRITION AND FOOD STATUS UNDER CONDITIONS OF LIMITED MOBILITY (HYPOKINESIA)

I. G. Popov and N. D. Radchenko Apr. 1981 13 p refs Transl. into ENGLISH from Gig. i Sanit. (USSR), no. 12, 2 Mar. 1976 p 26-32 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-76563) Copyright. Avail: Issuing Activity CSCL 06P

A study of actual nutrition and food status of persons receiving a ration of 3155 and 2822 cal. under conditions of hypokinesia with an average energy consumption of 2600 cal. was undertaken. The second ration proved to be insufficient for some of the participants. It is suggested that a diet under hypokinesia conditions should include a 10 to 15 percent caloric ration reserve in addition to the energy consumption rate to satisfy the individual food and energy requirements. E.A.K.

N81-27808# Federal Aviation Administration, Washington, D.C. Systems Research and Development Service.

A SYSTEMS ENGINEERING EVALUATION METHOD FOR PILOTED AIRCRAFT AND OTHER MAN-OPERATED VEHICLES AND MACHINES WITH HYPOTHETICAL EXAMPLE OF A SYSTEMS EVALUATION AND QUANTIFIED SYSTEM PERFORMANCE-WORKLOAD RATING SCALES Final Report

Thomas H. Higgins Mar. 1981 59 p refs

(AD-A099196; FAA-RD-81-30) Avail: NTIS HC A04/MF A01 CSCL 05/9

A systems evaluation method is presented which systematizes and quantifies both PRP pilot rating procedures and ECP engineering calculation procedure measures of system performance on a logarithmic ratio basis of test aircraft configurations compared to a known selected standard aircraft (vehicle) configuration. The logarithmic units 10 log (ECP test/ECP std) and 10 log (PRP test/PRP std) used in this system evaluation method are termed 'decivals dV' as they are 10 times the log base 10 of the ratio of the ECP and PRP values obtained during tests for the test aircraft configuration compared to the chosen standard aircraft configuration. The system evaluation is for chosen time periods of selected flight operations which are critical to flight safety, such as may occur during takeoff, or approach to landing and may include emergency engine failure, flight control or instrument malfunction conditions. System equations are presented which answer the question as to how good is the test configuration in relation to the known standard configuration during these same flight conditions. Potential ECP measures are discussed and their correlation with PRP pilot ratings obtained

during flight test or flight simulator test determines their retention as effective system performance and evaluation measures. The non-dimensional logarithmic nature of the retained ECP system performance descriptors allows their combination by logarithmic summation and their correlation with the PRP pilot ratings is determined. The combination of ECP measures having the highest correlation with pilot ratings is retained for final system evaluation. Author (GRA)

N81-27809# Dayton Univ., Ohio.
A MAN-MACHINE INTERFACE FOR ENERGY MONITORING AND CONTROL SYSTEMS Final Report, 1980 - 1981
Billy B. Wise Jun. 1981 42 p refs
(Contract F33615-77-C-2004)
(AD-A099884; CEL-CR-81.013) Avail: NTIS HC A03/MF A01 CSCL 05/8

Energy monitoring and control systems (EMCS) man-machine interface (MMI) requirements are defined. Existing EMCS MMI are reviewed along with current MMI technology. Recommendations for an improved EMCS are made. Author (GRA)

N81-27810# US Divers Co., Santa Ana, Calif. Survivair R and D Engineering Div.
A 2 1/2 HOUR DURATION, CLOSED CIRCUIT LIFE SUPPORT SYSTEM REPORT INCLUDING TEST REPORT AND OUTLINE FOR NIOSH CERTIFICATION Final Report, 29 May 1980 - 31 Mar. 1981
M. L. Kranz and M. A. Borrello 31 Mar. 1981 26 p refs
Prepared in cooperation with ILC Dover, Frederica, Del. Prepared for Army Chemical Systems Lab.
(Contract DAAK11-80-C-0059)
(AD-A099763; ILC-0000-74288) Avail: NTIS HC A03/MF A01 CSCL 06/11

A self contained, closed circuit breathing apparatus was developed for ILC Dover for the purpose of life support in a HCPCO (Hazardous Chemical Protective Clothing). Tests were performed to prove the design for life support compatibility over a duration period of 2.5 hours. Peripheral functions of the system were also tested. Recommendations were made from conclusive results. Finally an outline was presented for submitting the system for NIOSH certification. Author (GRA)

N81-27811# State Univ. of New York at Buffalo. Dept. of Industrial Engineering.
INDIVIDUAL DIFFERENCES IN DUAL-TASK PERFORMANCE Final Report, Mar. 1978 - Jun. 1980
Diane L. Damos and Thomas E. Smist Nov. 1980 80 p refs
(Contract N00203-78-M-3707; MF584002; ZF5852406)
(AD-A099977; NBDL-M006) Avail: NTIS HC A05/MF A01 CSCL 05/1

Eleven right-handed males participated in an experiment examining individual differences in multiple-task performance. Three task combinations were used in the study. The first was composed of a memory task and a classification task. The second consisted of two identical one-dimensional compensatory tracking tasks. The third was a dichotic listening task. On Day 1 of the experiment the subjects practiced each task alone. On Days 2, 3, and 4 they performed primarily under dual-task conditions. However, periodically dual-task practice was interrupted to reassess single-task performance. All dual-task data were analyzed first to determine when stability occurred. Each subject's stabilized data from the tracking-tracking and memory-classification combinations then were corrected for the appropriate single-task baseline. Finally, the subjects were grouped according to which of three response strategies they used to perform the memory-classification task combination. These strategies were a massed strategy (in which the subject would emit a series of response to one task before responding to the other), an alternating responses strategy, and a simultaneous response strategy. A two-way repeated measures MANOVA conducted on the stabilized adjusted data indicated both a significant effect of trials and groups. Possible sources of the between-group differences are discussed. Author (GRA)

N81-27812# Research Inst. of National Defence, Stockholm (Sweden).
COLOR CODING OF DISPLAYS, MAPS AND IMAGES
Gunilla Derefeldt Feb. 1981 78 p refs
(FOA-C-53003-H9) Avail: NTIS HC A05/MF A01

Color coding research is reviewed with respect to symbolic displays, sonar data, maps, and pictures. Color coding is discussed from a psychological point of view as a means of improving human performance in various visual tasks such as detection, search, identification, classification, and interpretation. It is concluded that observers exhibit a general subjective preference for color presentations. Provided the color code is well matched to the task at hand, color coding generally improves human performance. Color used as a completely redundant code is always beneficial. When used for symbol coding, color is disadvantageous compared to letters and digits for identifications. Color coded symbols might interfere with identification and search for achromatic targets. Author (ESA)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N81-27813*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
PROGRAMMER'S MANUAL FOR MMLE3, A GENERAL FORTRAN PROGRAM FOR MAXIMUM LIKELIHOOD PARAMETER ESTIMATION
Richard E. Maine Jun. 1981 118 p refs Document includes a microfiche supplement
(NASA-TP-1690; H-1105) Avail: NTIS HC A06/MF A01 CSCL 09B

The MMLE3 is a maximum likelihood parameter estimation program capable of handling general bilinear dynamic equations of arbitrary order with measurement noise and/or state noise (process noise). The basic MMLE3 program is quite general and, therefore, applicable to a wide variety of problems. The basic program can interact with a set of user written problem specific routines to simplify the use of the program on specific systems. A set of user routines for the aircraft stability and control derivative estimation problem is provided with the program. The implementation of the program on specific computer systems is discussed. The structure of the program is diagrammed, and the function and operation of individual routines is described. Complete listings and reference maps of the routines are included on microfiche as a supplement. Four test cases are discussed; listings of the input cards and program output for the test cases are included on microfiche as a supplement. E.D.K.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering.*

N81-27814* National Aeronautics and Space Administration. Pasadena Office, Calif.
HIGH-SPEED MULTIPLEXING OF KEYBOARD DATA INPUTS Patent
Tage O. Anderson, inventor (to NASA) (JPL, California Inst. of Technology, Pasadena) Issued 28 Apr. 1981 8 p Filed 29 Dec. 1978 Supersedes N79-14797 (17 - 05, p 0654) Sponsored

by NASA
(NASA-Case-NPO-14554-1; US-Patent-4,264,984; US-Patent-Appl-SN-974473; US-Patent-Class-364-900; US-Patent-Class-364-200; US-Patent-Class-370-58) Avail: US Patent and Trademark Office CSCL 09B

A high speed multiplexing system is described in which keyboard entered data is sequentially and automatically sampled by the multiplexing system for input to a computer. A sequencer is provided which sequentially and automatically controls the multiplexer to sample each keyboard input in accordance with a predetermined sampling sequence. Whenever keyboard entered data appears on input lines to the multiplexer, the system inputs the keyboard data to the computer during a brief time interval in which the multiplexer remains at the particular keyboard address or port. Thus, a high speed sampling circuit is provided whereby the only operator action required is data entry through a keyboard. Priority or interrupt systems are not required.
Official Gazette of the U.S. Patent and Trademark Office

N81-27815 British Library Lending Div., Boston Spa (England).
SIMULATION OF PCM TRANSMISSION ON A COMPUTER AND DIMENSIONING
E. Jorgensen (Norwegian Technical Univ., Trondheim) May 1980 14 p refs Transl. into ENGLISH from Telktronikk (Norway), no. 4, 1973 p 177-183
(BLL-RDL-Trans-3820-(7737.47)) Avail: British Library Lending Div., Boston Spa, England

The computer simulation of digital base band transmission and its use in dimensioning PCM connections and constructing generators is discussed. Also discussed is the problem of describing crosstalk. Statistics are proposed for estimating the crosstalk effect in random pair selection. It is also shown how dimensioning can be carried out in random pair selection. Examples of this and systematic pair selection are shown. M.G.

N81-27816 British Library Lending Div., Boston Spa (England).
DIGITAL CORRECTION PROCEDURE FOR THE ACCURACY/SPEED ENHANCEMENT OF FAST ANALOGUE-TO-DIGITAL CONVERSION
Manfred Zimmer Jan. 1981 23 p refs Transl. into ENGLISH from Eletroniker (Copenhagen), v. 17, no. 6 p EL 14-19
(BLL-RTS-12467) Avail: British Library Lending Div., Boston Spa, England

Procedures used to improve both the accuracy and the speed of direct analog to digital (A/D) conversion are reviewed. The problem of developing A/D converters of increasing speed and accuracy and simultaneously reducing cost and running expenses is discussed. In wideband HF data processing, in radar and video technology, it is still impossible to produce A/D converters on a monolithic basis, usually for reasons of speed, and the user must resort to expensive discrete or hybrid A/D converter systems. Easily realiable procedures for the correction of static errors are enumerated. E.A.K.

N81-27817# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
OPTIMAL BATCH RECURSIVE DATA COMPRESSION
Y. Medan and I. Y. Bar-Itzhack Mar. 1980 30 p refs
(TAE-399) Avail: NTIS HC A03/MF A01

A recursive linear optimal estimation method is presented which processes a batch of measured data at each estimation point. Due to this feature the method serves as a data compression scheme. This scheme is an integrated one in the sense that the optimization is performed on a pre-filter/estimator combination. The method is derived and compared for accuracy performance and complexity with the Kalman filter. It is found that a considerable saving in computational effort, with a minimal degradation of accuracy is achieved using this method. An example is presented and efficient algorithms to implement this method are developed. M.G.

N81-27818# Operations Research, Inc., Silver Spring, Md.
DEVELOPMENT OF SPECIAL PURPOSE COMPUTERS. ADVANCED NARROWBAND DIGITAL VOICE TERMINAL BREADBOARD Final Report
Apr. 1981 11 p
(Contract N00173-80-C-0087)
(AD-A099193) Avail: NTIS HC A02/MF A01 CSCL 09/2

This document summarizes the software development provided to the Naval Research Laboratory by ORI, Inc., under Contract No. N00173-80-C-0087. The objectives of this contract were the development of software for the signal processing computers and interface processors for the Advanced Narrowband Digital Voice Terminal (ANDVT) Breadboard, and to provide the system generation and software development of an Interactive Laboratory System (ILS). Author (GRA)

N81-27819# Defense Mapping Agency, Washington, D.C.
SYNCHRONOUS NETS FOR SINGLE INSTRUCTION STREAM: MULTIPLE DATA STREAM COMPUTERS
Annette J. Krygiel 28 May 1981 36 p refs
(AD-A099726) Avail: NTIS HC A03/MF A01 CSCL 09/2

Synchronous Nets, or S Nets, are developed as a modeling tool particularized for describing processes on Single Instruction Stream, Multiple Data Stream (SIMD) computers. S Nets are a modification of Petri Nets, using transitions and places to model events and conditions. However S Nets introduce vector-mask places to model the conditions of the array resources of SIMD machines. These places are distinguished from scalar places which model the scalar resources. S Nets also introduce a new kind of transition. One type correlates with the Petri Net transition, but the mask firing transition is particularized to the SIMD environment, modeling the inherent capability of a computation executing on a SIMD machine to alter the participation of the vector aggregates in successor events. Author (GRA)

N81-27820# Harry Diamond Labs., Adelphi, Md.
INVESTIGATIONS OF PHOTOVOLTAIC FERROELECTRIC-SEMICONDUCTOR NONVOLATILE MEMORY
Philip S. Brody Mar. 1981 31 p refs
(DA Proj. 1L1-61101-A-91A)
(AD-A099516; HDL-TR-1948) Avail: NTIS HC A03/MF A01 CSCL 09/2

The feasibility of a new kind of nonvolatile digital memory is proposed and examined. The basis of the memory is an anomalous photovoltaic phenomenon found in ferroelectric ceramics, a photovoltage with a polarity that depends on the direction of the remanent polarization. Described are proposed memory cell structures that function in matrix arrangements as nonvolatile read/write random access memory or electrically alterable programmable read-only memory. Test results obtained with an experimental test unit are also described. Included is a survey of methods for producing ferroelectric films.Author (GRA)

N81-27821# L N K Corp., Inc., Silver Spring, Md.
THE DESIGN AND ANALYSIS OF A HIGH-PRODUCTION MINI-COMPUTER SYSTEM FOR REGRIDDING DIGITAL TERRAIN ELEVATION MATRICES Final Report
George C. Stockman, Russell C. Smith, and I-Lok Chang Ft. Belvoir, Va. Army Engineer Topographic Labs. Oct. 1980 79 p refs
(Contract DAAK70-80-C-0022)
(AD-A100034; ETL-0240) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report studies a new algorithm for the regridding and transformation of Digital Terrain Elevation Matrices. The new algorithm uses sequential accesses to mass storage devices rather than the random methods used by the software system currently installed at the Defense Mapping Agency. Due to the simplicity of the new algorithm, minicomputers can be used in place of a larger mainframe computer. Four potential minicomputer systems are examined. Benchmark test results are given which show the feasibility of minicomputer use. Recommendations are made concerning the minicomputer to select if the new algorithm is to be implemented. Author (GRA)

N81-27822# Washington Univ., Seattle. Dept. of Computer Science.
GLOBAL STATES OF A DISTRIBUTED SYSTEM
Michael J. Fischer, Nancy D. Griffeth (Georgia Inst. of Tech.), and Nancy A. Lynch (Georgia Inst. of Tech.) Jun. 1981 10 p refs
(Contracts N00014-80-C-0221; DAAG29-79-C-0155; N00014-79-C-0873; Grants NSF MCS-77-02474; NSF MCS-77-15628; NSF MCS-80-03337)
(AD-A099804; TR-81-05-02) Avail: NTIS HC A02/MF A01

CSCL 09/2

A global state of a distributed transaction system is consistent if no transactions are in progress. A global checkpoint is a transaction which must view a globally consistent system state for correct operation. We present an algorithm for adding global checkpoint transactions to an arbitrary distributed transaction system. The algorithm is non-intrusive in the sense that check-point transactions do not interfere with ordinary transactions in progress; however, the checkpoint transactions still produce meaningful results. Author (GRA)

N81-27823# Fondazione Ugo Bordoni, Rome (Italy).
IMPLEMENTATION OF AN OPTIMAL CORRECTION STEP EQUALIZER IN THE INTEL 8080 MIROPROCESSOR [IMPLEMENTAZIONE DELL'EQUALIZZATORE A PASSO DI CORREZIONE INTERNA OTTIMALE SU MICRO INTEL 8080]
F. Cascio, G. Martinelli (Rome Univ.), G. Orlandi (Rome Univ.), and M. Salerno (Rome Univ.) Sep. 1980 13 p refs In ITALIAN
(FUB-23-1980) Avail: NTIS HC A02/MF A01

The overall management program of an optimal correction step equalizer for INTEL 8080 microprocessor is described. The flow diagram of the management program and the listing of the overall program are presented. The equalizer work starts with a training phase followed by an adaptive phase. The instructions added to pass from the training to the adaptive phase include error computation, phase indicator testing, scale corrections and insertion of incoming data sampling. A listing of the program is included. Author (ESA)

N81-27824# Sutron Corp., Arlington, Va.
TECHNOLOGY ASSESSMENT OF FLEXIBLE DISKS AS USED IN STAND ALONE TEXT PROCESSING SYSTEMS Final Report
W. Gene Dickamore and Ingrid K. Dampler Nov. 1980 86 p refs
(Contract NB79-SBCA-0141)
(PB81-171365; SCR-354-80-036A; NBS-GCR-80-307) Avail: NTIS HC A05/MF A01 CSCL 09B

Included are: identifying alternatives to the flexible disk cartridge for providing information interchange between stand alone word processors; defining the technical problems associated with flexible disk cartridge information interchange; surveying the Federal Government to ascertain the volume and different types of stand alone text processors currently being used and the 5 year projection of word processing equipment needed; identifying negative impacts from the establishment of a label format and file structure standard for flexible disk cartridges; and identifying all costs and benefits that would accrue to the Federal Government as a result of a label and file structure standard for flexible disk cartridges used in stand alone work processors. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N81-27825*# Vought Corp., Hampton, Va.
MAIL LOG, PROGRAM THEORY, VOLUME 1
Danny K. Harris May 1979 548 p 2 Vol.
(Contract NAS1-13500)
(NASA-CR-159063) Avail: NTIS HC A23/MF A01 CSCL 09B

The program theory used to obtain the software package, MAIL LOG, developed for the Scout Project Automatic Data System, SPADS, is described. The program is written in FORTRAN for the PRIME 300 computer system. The MAIL LOG data base consists of three main subfiles: (1) incoming and outgoing mail correspondence; (2) design information releases and reports; and (3) drawings and engineering orders. All subroutine descriptions, flowcharts, and MAIL LOG outputs are given and the data base design is described. M.G.

N81-27826*# National Aeronautics and Space Administration, Washington, D. C.
PROGRAMMING INPUT-OUTPUT OPERATIONS IN FORTRAN ON MAGNETIC TAPE
V. N. Gorokov Jun. 1980 10 p Transl. into ENGLISH of "Programmirovaniye na Fortrane Operatsiy Vvoda-vyvoda na Magnitnuyu Lentu" Rept. Pr-362, Moscow, 1977 p 1-9 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Inst. of Space Research, Academy of Sciences (USSR)
(Contract NASw-3198)
(NASA-TM-76231) Avail: NTIS HC A02/MF A01 CSCL 09B

The subprogram MTCFF was designed for carrying out input-output operations in FORTRAN on magnetic tape within the framework of the DOS ES EVM operation system. It is possible, by means of this subprogram, to perform any input-output operations of interest to the programmer such as recording and reading various control operations in the direct and reverse directions, even though for these purposes the facilties of the language FORTRAN itself are limited. The subprogram can also be used in programs written in other programming languages. E.D.K.

N81-27827*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
REQUIREMENTS AND PRELIMINARY DESIGN FOR A GENERAL PURPOSE REAL-TIME EXECUTIVE FOR FLIGHT COMPUTERS
Kathryn A. Smith Jun. 1981 21 p refs
(NASA-TM-83167) Avail: NTIS HC A02/MF A01 CSCL 09B

The requirements and preliminary design of a general purpose, real-time executive computers program for flight computers are provided. A description and the requirements are included for the major elements of the executive: an initialization model, a task scheduler, and an interrupt handler. Task priorities and various process interrupts are discussed. System parameters and variables are identified which make the design adaptable to various flight computer and applicaton specifications. Author

N81-27828*# Vought Corp., Hampton, Va.
MAIL LOG, PROGRAM THEORY, VOLUME 2
Danny K. Harris May 1979 627 p 2 Vol.
(NAS1-13500)
(NASA-CR-159064) Avail: NTIS HC A99/MF A01 CSCL 09B

Information relevant to the MAIL LOG program theory is documented. The L-files for mail correspondence, design information release/report, and the drawing/engineering order are given. In addition, sources for miscellaneous external routines and special support routines are documented along with a glossary of terms. M.G.

N81-27829*# Vought Corp., Hampton, Va. Technical Center.
MAIL LOG, PROGRAM SUMMARY AND SPECIFICATIONS
Danny K. Harris May 1979 121 p
(Contract NAS1-13500)
(NASA-CR-159066) Avail: NTIS HC A06/MF A01 CSCL 09B

The summary and specifications to obtain the software package, MAIL LOG, developed for the Scout Project Automatic Data System, SPADS are provided. The MAIL LOG program has four modes of operation: (1) input - putting new records into the data base; (2) revise - changing or modifying existing records in the data base; (3) search - finding special records existing in the data base; and (4) archive - store or put away existing records in the data base. The output includes special printouts of records in the data base and results from the input and search modes. Author

N81-27830# Maryland Univ., College Park. Computer Vision Lab.
DIGITAL IMAGE RESTORATION USING CONDITIONAL MARKOV MODELS Interim Report
R. Chellappa Mar. 1981 24 p refs
(Contract AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A100002; TR-1027; AFOSR-81-0468TR) Avail: NTIS

HC A02/MF A01 CSCL 09/2

We are interested in developing digital image restoration algorithms using a class of spatial interaction models known as conditional Markov models. Our approach is to represent the images by Markov models on toroidal lattices and develop minimum mean square error (MMSE) restoration algorithms. The algorithms are non-recursive in structure and due to the underlying representation on toroidal lattices can be implemented using FFT algorithms. We give two types of algorithms. First we assume that a prototype of the original image is available and develop algorithms for restoration of degraded images. The degradation is assumed to be due to a known space invariant, non-separable, periodic point spread function and additive white noise. Secondly, we consider the more general situation when a prototype image is not available and give algorithms for MMSE filtering of noisy images. Experimental results are given for the above cases. Author (GRA)

N81-27831# California Univ., Berkeley. Operations Research Center.

RANDOM LINEAR PROGRAMS

Ilan Adler and Sancho E. DeB. Berenguer (Brazil Univ., Rio de Janeiro) Mar. 1981 37 p refs

(Contract N00014-76-C-0134; NR Proj. 047-033)

(AD-A099812; ORC-81-4) Avail: NTIS HC A03/MF A01 CSCL 12/2

In this paper, we study the random generation of a linear program of the type P : Max cx subject to Ax or b. We assume these random variables to be independent and symmetric around zero and to have continuous distribution functions, therefore, transforming the random generation problem into a distribution free combinatorial problem. Making use of the theory of d-Arrangements, we compute the probabilities of P being feasible and bounded, and we also calculate the expected number of faces, of all possible dimensions, of the polytope that is the feasibility set of P, given that P is feasible. GRA

N81-27832# California Univ., Berkeley. Operations Research Center.

A COMPLEMENTARITY ALGORITHM FOR OPTIMAL STATIONARY PROGRAMS IN GROWTH MODELS WITH QUADRATIC UTILITY

Chia-Shin Chung and David Gale May 1981 16 p refs

(Contract N00014-76-C-0134; Grant NSF SES-78-05196)

(AD-A100066; ORC-81-10) Avail: NTIS HC A02/MF A01 CSCL 12/1

It is shown that under natural economic assumptions the complementary pivot algorithm will find an optimal steady state for a von Neumann growth model with a quadratic utility function. This generalizes the result of Dantzig and Mann for the case of linear utility. Author (GRA)

N81-27833# Dayton Univ., Ohio.

STRUCTURAL ANALYSIS POSTPROCESSING UTILITIES Final Report, Mar. - Sep. 1980

Robert A. Brockman, M. E. Wright, M. P. Bouchard, and M. J. Hecht Wright-Patterson AFB, Ohio AFWAL Jan. 1981 95 p refs

(Contract F33615-80-C-3403; AF Proj. 2402)

(AD-A099530; UDR-TR-80-110) Avail: NTIS HC A05/MF A01 CSCL 09/2

Three computer graphics programs, designed to present the results of finite element structural analysis in a readily assimilated form, are described. The first, GPLOT, performs plotting of original and/or deformed mesh geometries. A second program, CPLOT, produces contour or relief maps of displacement, strain or stress results. These two programs are command-driven and offer a wide variety of display options. The third program, XYPLOT, generates variable-versus-variable plots with user-defined labeling, symbols, titling and plot size. The graphics programs are operational with Tektronix and Hewlett-Packard display devices, on CDC and VAX machines. Author (GRA)

N81-27834# Oak Ridge National Lab., Tenn.

CONTRIBUTION TO SCREENING METHODOLOGY

F. G. Perey Mar. 1981 49 p refs

(Contract W-7405-eng-26)

(ORNL-5744) Avail: NTIS HC A03/MF A01

The screening method for determining objective approximate values for the sensitivity coefficients of the output of a computer code to the input data is analyzed. An estimator proposed to solve such problems is used to investigate one of the outputs of a simplified model of the long term energy analysis program (LEAP) of the Energy Information Administration (EIA). The results are presented and compared to the values of the sensitivity coefficients. The estimator produces results that appear more arbitrary than approximate. The screening problem is analyzed from the point of view of a theory of logical inference, and it is argued that no objective, approximate, and useful solution exists for a code treated as a black box since no degree of confidence can be placed on the solution. Requirements on additional information needed to produce a solution that could qualify as objective, approximate, and useful are investigated. DOE

N81-27835# Bendix Field Engineering Corp., Grand Junction, Colo.

OREDIT: A FORTRAN COMPUTER PROGRAM TO PROCESS OAK RIDGE HSSR DATA

R. J. Zinkl, R. F. DAndrea, Jr., and D. L. Shettel, Jr. Jan. 1981 32 p refs

(Contract DE-AC13-76GJ-01664)

(GJBX-10(81)) Avail: NTIS HC A03/MF A01

A FORTRAN program is presented that reads, edits, and sorts the hydrogeochemical and stream sediment reconnaissance (HSSR) data produced by the Oak Ridge Gaseous Diffusion Plant for the National Uranium Resource Evaluation program. The data are sorted into groups of stream sediment, stream water, and ground water samples. Extraneous information is eliminated and missing analyses are assigned a specific value. The output from this program consumes considerably less disk space than the original unsorted data file. Allowances are made for elemental analyses not currently performed by ORGDP, so that the program is not likely to become obsolete. DOE

N81-27836# Bendix Field Engineering Corp., Grand Junction, Colo.

FORTRAN COMPUTER PROGRAMS TO READ, SORT, AND EDIT LOS ALAMOS HYDROGEOCHEMICAL DATA

R. J. Zinkl, R. F. DAndrea, Jr., and D. L. Shettel, Jr. Jan. 1981 45 p ref

(Contract DE-AC13-76GJ-01664)

(GJBX-11(81)) Avail: NTIS HC A03/MF A01

Hydrogeochemical and stream sediment reconnaissance (HSSR) data covering large portions of Alaska, Montana, Wyoming, Colorado, and New Mexico are published by Los Alamos Scientific Laboratory (LASL) and are available on magnetic tape through Oak Ridge National Laboratory. Three separate FORTRAN computer programs are used to read LASL HSSR data. Program LASORT reads single element water and sediment data, program LASLWS reads multielement water data, and program LASLSS reads multielement sediment data. All three programs identify and eliminate questionable data records, subset the data according to simple type, and exclude extraneous data from the output files. DOE

N81-27837# Bendix Corp., Kansas City, Mo.

SOFTWARE DOCUMENTATION FOR COMPRESSION-MACHINE CAVITY CONTROL

R. H. Floersch Apr. 1981 249 p

(Contract DE-AC04-76DP-00613)

(BDX-613-2603) Avail: NTIS HC A11/MF A01

A new system design using closed loop control on the hydraulic system of compression transfer presses used to make filled elastomer parts will result in improved accuracy and repeatability of speed and pressure control during critical forming stages before part cure. The new design uses a microprocessor to supply set points and timing functions to the control system. Presented are the hardware and software architecture and objectives for the microprocessor portion of the control system. DOE

N81-27838# Oak Ridge National Lab., Tenn. Fusion Energy Div.

SOFTWARE ENHANCEMENT TO PRODUCE REPORT-QUALITY GRAPHICS FROM GIFTS

W. H. Gray and T. V. Baudry Mar. 1981 21 p refs

(Contract W-7405-eng-26)
(ORNL/TM-7666) Avail: NTIS HC A02/MF A01

The Oak Ridge National Laboratory (ORNL) version of the Graphics Oriented Interactive Finite Element Time Sharing System (GIFTS) structural analysis computer program modules is addressed. The local software enhancements for the ORNL version of GIFTS are presented that permit the creation of intermediate graphics files that may be postprocessed to produce report quality display images on a variety of graphics devices at ORNL. DOE

N81-27839# Bosch (Robert) G.m.b.H., Darmstadt (West Germany). Geschaeftsbereich Fernsehanlagen.

A COMPUTERIZED GEOMETRICAL ANALYSIS SYSTEM: FUNCTIONAL EXTENSION Final Report

Gerhard Kamin Bonn Bundesministerium fuer Forschung und Technologie Dec. 1980 100 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-144; ISSN-0340-7608;
BMFT-13N1091/NT1094) Avail: NTIS HC A05/MF A01

A geometry computer system, already developed for automatic quantitative image analysis, was expanded to include several important functions. A two dimensional autodiscrimination technique for the suppression of image haloes is now implemented. An interactive system is shown which couples the geometry computer to a digital computer and gives the operator direct access to the picture through use of lightpen electronics. An image circulation technique and a high quality measuring camera are also available. Pattern generation and image alienation techniques are briefly described as innovative by products.
Author (ESA)

N81-27840# Research Inst. of National Defence, Stockholm (Sweden).

COMPUTER SIMULATION OF SATELLITE IMAGERY

T. Rhaug and G. Forssell Jan. 1981 48 p refs
(FOA-C-30212-E1,T3) Avail: NTIS HC A03/MF A01

Image simulation at different resolutions using computer methods is described. The original image is an aerial photographic image having an effective instantaneous field of view (IFOV) on ground of 10 cm. Using linear filtering, images of different and lower resolution were generated. The IFOV's chosen correspond to imagery from civilian and non-civilian satellites and represent various camera resolutions. From the result an attempt is made to evaluate the size of targets to be detected and identified for various levels of resolution. Author (ESA)

N81-27841# Research Inst. of National Defence, Stockholm (Sweden).

ACTIVITIES OF THE LABORATORY FOR COMPUTER SCIENCE FOA-32 AND THE ENGINEERING PSYCHOLOGY AND INFORMATION SYSTEMS FOA-53 Annual Report, 1980

Jan. 1981 40 p refs
(FOA-C-30215-E1) Avail: NTIS HC A03/MF A01

Various concepts in the areas of computerized image processing, visual processing of pictorial information, and the computer programming required to support these activities are presented. Work is described on information retrieval systems, data security, human decision making, man-computer communication and edge detection. Author (ESA)

N81-27842# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Regelungssysteme.

SYSTEMATIC CONTROLLER DESIGN BY OPTIMIZATION OF A VECTOR PERFORMANCE INDEX: DESIGN PERFORMANCE BY THE COMPUTER PROGRAM REMVG

Reinhold Steinhauser Oct. 1980 102 p refs In GERMAN; ENGLISH summary
(DFVLR-Mitt-80-18) Avail: NTIS HC A06/MF A01

An iterative controller design scheme is presented. By optimization of a vectorial performance index composed of the various design specifications, the free controller parameter in a given feedback control structure is determined. This controller design scheme is implemented in a suitable computer program. The essential features of this program are described, and interactive design of controllers is explained. Analysis and simulation parameters show that a systematic improvement of the result is obtained from design step to design step, even when many design specifications are satisfied. Author (ESA)

N81-27843# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.

M7: A GENERAL PATTERN MATCHING FACILITY USERS MANUAL

A. R. Marriott, G. H. Skillman, S. B. Salazar, and W. T. Hardgrave Jan. 1981 40 p refs
(PB81-164758; NBSIR-80-2182) Avail: NTIS HC A03/MF A01 CSCL 09B

M7, a general pattern matching and replacement facility, is described. It is based on such macroprocessors as M6, MORTRAN, and STAGE 2, and is implemented in the language C on UNIX. By incorporating such features as stacks, counters, and tags, M7 is particularly useful for translating or reformating queries, languages, and data. GRA

N81-27844# Health Effects Research Lab., Research Triangle Park, N. C. Biometry Div.

THE AMES TEST CURVE FITTING PROGRAM. A USER'S GUIDE

Vic Hasselblad, Andy Stead, John Creason, and Violette Kasica Sep. 1980 60 p refs
(PB81-156267; EPA-600/2-80-184) Avail: NTIS HC A04/MF A01 CSCL 09B

The Ames Test Curve Fitting program is a FORTRAN program which fits a nonlinear dose response curve to count (Poisson) data. The program was written specifically for analyzing Ames test data, although it is possible that the program could have other applications. The curve fitted is of the form $(a+exp(b+clog(X))\exp(-dx)$ where a, b, c and d are parameters to be estimated. If the parameter d is very near zero, then d is dropped from the model and a reduced model is fitted. Tests of goodness, of fit and for the significance of the parameters are made using likelihood ratio tests. The program has optional graphics capability for producing plots of the data and the estimated curve. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N81-27845# Teledyne Geotechnical, Alexandria, Va. Seismic Data Analysis Center.

EVALUATION OF THE COMMUNICATIONS CONTROL PROCESSOR

W. C. Dean, D. M. Miller, and R. P. Colella Vela Seismological Center. 7 May 1981 102 p refs
(Contract F08606-78-C-0007; ARPA Order 2551)
(AD-A099186; SDAC-TR-79-6; VSC-TR-81-7) Avail: NTIS HC A06/MF A01 CSCL 09/2

This report evaluates the role of the pluribus, a multiprocessor/multibus system, in its role as the communications control processor (CCP) at the Seismic Data Analysis Center (SDAC) over the 26 months from its installation in April 1977 through May 1979. In capacity the six processor Pluribus at the SDAC provides a bandwidth somewhat greater than 750,000 instructions per second, equivalent to three processors working full time. For the 16.8 KB/sec input and 28.2 KB/sec output data streams at SDAC operating in May 1979 this capacity is in excess of double the bandwidth required. The hardware reliability of the Pluribus lives up to its billing. However, the system suffered over 8% downtime, primarily due to software problems. The CCP is in an R D environment at SDAC which required revisions of the CCP inputs and functions over the 26 months of operation studied. GRA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N81-27846 Sheffield Univ. (England). Dept. of Control Engineering.

MULTIVARIABLE ROOT-LOCI: AN EMERGING DESIGN TOOL?
D. H. Owens Sep. 1980 8 p refs Presented at IEE Intern. Conf. on Control and its Appl., Conventry, Engl., Mar. 1981
(RR-122) Avail: NTIS HC A02

Useful theory of root-loci for linear multivariable feedback systems is reviewed. A practical compensation theory, based on the use of forward path and minor loop compensation elements to manipulate asymptotic directions and pivots of all orders of infinite zero, is presented. The structure, use and control of the asymptotic behavior of multivariable (multi-input/multi-output) root-loci in systems design with frequency domain methods, using encirclement theorems, is emphasized. Due to pathological cases, sensitivity problems, and a very weak relationship between root-locus structure and closed loop transient performance, the role of plant zeros in compensator design is obscured. Nonetheless, root-locus concepts are valuable in predicting and assessing the source of control difficulties. Author (ESA)

N81-27847 Sheffield Univ. (England). Dept. of Control Engineering.
VARIABLE STRUCTURE CONTROL OF ADAPTIVE MODEL FOLLOWING SYSTEMS
A. S. I. Zinober, O. M. E. El-Ghezawi, and S. A. Billings Sep. 1980 6 p refs
(RR-123) Avail: NTIS HC A02

The basic theory of variable structure systems is outlined, and sliding motion is explained together with the equivalent control concept and its application to adaptive model-following systems. The advantage of the method is that it provides a systematic and effective procedure in specifying the transient response of the error. Variable structure systems theory is applied to the design of adaptive controllers for a second order dc drive and a fourth order multivariable system. Insensitivity to parameter variations and disturbances is achieved. Most designs can be realized without a computer. The controllers are easily implemented with the aid of microprocessors. Author (ESA)

N81-27848# Operating Systems, Inc., Woodland, Calif. AIS Data Base Generation.
AIS DATA BASE GENERATION Final Technical Report, 15 Dec. 1979 - 15 Jan. 1980
Donald L. Dwiggins and Geogette M. Silva Griffiss AFB, New York RADC Apr. 1981 55 p refs
(Contract F30602-80-C-0047; AF Proj. 4594)
(AD-A099205; OSI-81-002; RADC-TR-81-43) Avail: NTIS HC A04/MF A01 CSCL 09/2

The development of MATRES 3, a language understanding system for automated generation of AIS data base elements, is documented. The need for a high volume message processing technology in the I/W environment is discussed. The methodological approach adopted in MATRES 3 for analysis/description of event report is described and background information on conceptually relevant efforts is provided. An overview of message processing from raw text input to final output of event record in MATRES 3 is presented. E.D.K.

N81-27849# Illinois Univ. at Urbana. Dept. of Metal and Mining Engineering.
FRACTURE KINETICS OF HYDROGEN EMBRITTLED NIOBIUM
Barry Scott Hindin and H. K. Birnbaum Mar. 1981 81 p refs
(Contract N00014-75-C-1012)
(AD-A099194) Avail: NTIS HC A05/MF A01 CSCL 09/2

Kinetics of crack propagation in hydrogen charged niobium were studied in the temperature range 77 to 303 K and for hydrogen concentrations between 0.068 and 3.2 at.%. Crack velocities between 10 to the minus 8th power were determined as a function of the Mode I stress intensity factors using single edge notch and double torsion specimens. Validity of the double torsion technique was established using a variety of methods including photoelastic analysis of the stresses in the plane normal to the specimen's crack surface. Differences between crack velocities in deuterium and hydrogen charged specimens were consistent with the isotopic differences in their diffusion coefficients. Fracture surface of the test specimens were examined and shown to exhibit features consistent with their crack velocity behavior. Author

N81-27850# Sheffield Univ. (England). Dept. of Control Engineering.
SCHUR MULTIPLICATION AND ITS APPLICATION TO SYSTEMS THEORY
S. P. Banks Sep. 1980 29 p refs
(RR-119) Avail: NTIS HC A03/MF A01

Methods are developed which use Schur products for linear feedback systems. A distributive law, applicable to both large-scale multivariable systems and infinite-dimensional systems, is given. The treatment is applied to different areas of systems theory and examples are given. It is seen that given a matrix A, introducing a Schur multiplier K in order to influence some aspect of the system by replacing A with K*A, it is possible to control each element of A independently. A greater freedom in the choice of K is thus possible. The diversity and ease of application encountered in the examples chosen indicates many promising future applications. Author (ESA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N81-27851*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TWO-BOUNDARY GRID GENERATION FOR THE SOLUTION OF THE THREE DIMENSIONAL COMPRESSIBLE NAVIER-STOKES EQUATIONS Ph.D. Thesis - Old Dominion Univ.
R. E. Smith May 1981 172 p refs
(NASA-TM-83123) Avail: NTIS HC A08/MF A01 CSCL 12A

A grid generation technique called the two boundary technique is developed and applied for the solution of the three dimensional Navier-Stokes equations. The Navier-Stokes equations are transformed from a cartesian coordinate system to a computational coordinate system, and the grid generation technique provides the Jacobian matrix describing the transformation. The two boundary technique is based on algebraically defining two distinct boundaries of a flow domain and the distribution of the grid is achieved by applying functions to the uniform computational grid which redistribute the computational independent variables and consequently concentrate or disperse the grid points in the physical domain. The Navier-Stokes equations are solved using a MacCormack time-split technique. Grids and supersonic laminar flow solutions are obtained for a family of three dimensional corners and two spike-nosed bodies. M.G.

N81-27852*# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
EQUATIONS FOR THE ANGLES OF ARRIVAL AND DEPARTURE FOR MULTIVARIABLE ROOT LOCI USING FREQUENCY-DOMAIN METHODS
Andrew E. Yagle Jul. 1981 14 p refs
(Grant NGL-22-009-124)
(NASA-CR-164551; LIDS-P-1104) Avail: NTIS HC A02/MF A01 CSCL 12A

Frequency domain methods are used to study the angles of arrival and departure for multivariable root loci. Explicit equations are obtained. For a special class of poles and zeros, some simpler equations that are generalizations of the single input/single output equations are presented. M.G.

N81-27853# Massachusetts Inst. of Tech., Cambridge. Center for Information Systems Research.
IMPLEMENTATION AND EVALUATION OF A GRAPH PARTITIONING TECHNIQUE BASED ON A HIGH-DENSITY CLUSTERING MODEL
James M. Lattin Feb. 1981 68 p refs
(Contract N00039-80-K-0573)
(AD-A099221; CISR-P010-8102-15; CISR-TR-15) Avail: NTIS HC A04/MF A01 CSCL 12/1

Complex design problems are characterized by a multitude of competing requirements. System designers frequently find the

scope of the problem beyond their conceptual abilities, and attempt to cope with this difficulty by decomposing the original design problem into smaller, more manageable subproblems. In the SDM research effort, a systematic approach has been proposed for the decomposition of the set of functional requirements of a design problem into subsets (called subproblems) to form a design structure that will exhibit key characteristics of good design: strong coupling among requirements within subproblems and weak coupling between subproblems. This report documents the implementation of an efficient graph partitioning technique based on a high-density clustering model. The new method identifies the 'high-density regions' in the graph, which are sets of functional requirements exhibiting a relatively high degree of interdependency, and associates them with the different subsets of the design problem. The new technique, as currently implemented, is applied to several problems from the design literature. The results indicate that the proposed approach gives solutions that are conceptually and intuitively appealing, and that these partitions are consistent with the currently accepted decomposition. Although direct comparison with computational requirements of other partitioning procedures is difficult due to different machine implementations, the empirical evidence suggest that the new method is useful for decomposing design problems too large for the procedures currently in use. Author (GRA)

N81-27854# Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.

ASSESSMENT OF AVAILABLE INTEGRATION ALGORITHMS FOR INITIAL VALUE ORDINARY DIFFERENTIAL EQUATIONS. SELECTIONS FOR THE CRNL SUBROUTINE LIBRARY AND SIMULATION PACKAGES

M. B. Carver, D. G. Stewart, and J. L. Liu Nov. 1979 95 p refs

(AECL-6220) Avail: NTIS (US Sales Only) HC A05/MF A01; DOE Depository Libraries

The basic logistics of the integration process are described, common areas of difficulty are identified, and comprehensive test profile for integration algorithms is established. A number of algorithms are described, and selected published subroutines are evaluated using the test profile. An effective library for general use needs only two such routines. The two selected are versions of the well known Gear and Runge-Kutta-Fehlberg algorithms. DOE

N81-27855# Oak Ridge National Lab., Tenn. Environmental Sciences Div.

ICM: AN INTEGRATED COMPARTMENT METHOD FOR NUMERICALLY SOLVING PARTIAL DIFFERENTIAL EQUATIONS

G. T. Yeh May 1981 144 p refs

(Contract W-7405-eng-26)

(ORNL-5684; ESD-Publ-1585) Avail: NTIS HC A07/MF A01

An integrated compartment method (ICM) is proposed to construct a set of algebraic equations from a system of partial differential equations. The integral formulation eases the treatment of boundary conditions, in particular, the Neumann-type boundary conditions. The flexibility of discretization with irregular compartments of various shapes and sizes offers advantages in resolving complex boundaries enclosing compound regions of interest. The basic procedures of ICM are first to discretize the region of interest into compartments, then to apply three integral theorems of vectors to transform the volume integral to the surface integral, and finally to use interpolation to relate the interfacial values in terms of compartment values to close the system. The Navier-Stokes equations are used as an example of how to derive the corresponding ICM alogrithm for a given set of partical differential equations. Because of the structure of the algorithm, the basic computer program remains the same for cases in one, two, or three dimensional problems. DOE

N81-27856# Fondazione Ugo Bordoni, Rome (Italy).

NUMERICAL MULTIPLEXING OF TRIBUTARIES OF THE FOURTH HIERARCHIAL ORDER [MULTIPLAZIONE NUMERICA DI TRIBUTARI DEL QUARTO ORDINE GERARCHICO]

Odorado Brugia, Romolo Pietroiusti (SIP), and William Wolfowicz Oct. 1979 11 p refs In ITALIAN

(FUB-40-1979) Avail: NTIS HC A02/MF A01

Frame-structure strategies for fourth order multiplexing at (139,264) Mbit/sec in an Italian coaxial cable network cable network are compared. The centered frame alignment includes the whole alignment word in the transmitted numerical flow, while the decentered frame alignment includes only a part of the alignment information in each tributary flow. The individual alignment information is detected in reception for the autonomous control of the multiplexed flow. Definitions and tables for comparison of both technologies are included. Author (ESA)

N81-27857# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.

ON THE DECAY IN L SUB P OF SOLUTIONS TO CERTAIN NONLINEAR HYPERBOLIC EQUATIONS

Philip Brenner 1980 30 p refs

(CTH-Math-1980-10) Avail: NTIS HC A03/MF A01

Decay and scattering results obtained for nonlinear Klein-Gordon equations are extended and improved by the systematic use of Lp-Lp estimates. Various assumptions are made in the calculations and different lemmas are used. The method used applies equally well to the variable coefficient case provided certain a priori estimates hold. These estimates which hold for the constant coefficient case also hold for certain variable coefficient problems. Author (ESA)

N81-27858# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.

ON POLYNOMIAL CHAOS AND INTEGRABILITY

Christer Borell 1980 21 p refs

(CTH-Math-1980-12) Avail: NTIS HC A02/MF A01

The mathematical procedure used to estimate the quantity sup (double modulus X subp; double modulus X sub2, X belongs to script P) as a function of P belongs to)2, + infinity (from the given polynominal chaos is presented. A probability space (omega, script A,P) and class script C=(Vsubi) sub(i belongs to N) of vector subspaces of Lsub(2) (omega script A,P; script R) possessing the following properties are considered: Vsubi perpendicular to script R, i belongs to script N; dim Vsubi = d, i belongs to script N (1 < or = d < + infinity); the sigma algebras sigma (epsilon; epsilon belongs to Vsubi), i belongs to script N, are stochastically independent. Sufficient conditions are sought for script and B (any Banach space) to ensure that the nth B volued polyminal choos generated by script C, is contained as a subclass within L sub(P) (omega script A, P; B). Author (ESA)

N81-27859# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.

LIMIT THEOREMS FOR SUMS DETERMINED BY BRANCHING AND OTHER EXPONENTIALLY GROWING PROCESSES

Peter Jagers and Olle Nerman 1980 41 p refs Sponsored by Swedish National Science Foundation

(CTH-Math-1980-13) Avail: NTIS HC A03/MF A01

A branching process counted by a random characteristic is defined as a process which at time t is the superposition of individual stochastic processes evaluated at the actual ages of the individuals of a branching population. Characteristics which depend not only on age, but also on absolute time are considered. For supercritical processes, a distributional limit theorem is proved which implies that classical limit theorems for sums of characteristics evaluated at a fixed age point transfer into limit theorems for branching process counted by these characteristics. Although characteristics of different individuals should be independent, the characteristics of an individual may well interplay with its reproduction. The result requires L sup p continuity for 1 < or = p < or = 2. Its proof is valid for a wider class of processes than branching ones. For the case p = 1, a number of Poisson limits follow and for p = 2, normality approximation are concluded. Author (ESA)

N81-27860# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.

ALGEBRAIC GEOMETRY OF TERNARY QUADRATIC FORMS AND ORDERS IN QUATERNION ALGEBRAS

Juliusz Brzezinski 1980 9 p refs

(CTH-Math-1980-15) Avail: NTIS HC A02/MF A01

The form f (a ternary quadratic with integral coefficients)

defines two objects, a Z-scheme M(f) and a Z-order O(f), where Z denotes the integers. If f = X squared + Y squared + Z squared, then M(f) = Proj (Z[x,y,z]/(f)) and O(f) is the ring of the Lipschitz integral quaternions. Relations between these two kinds of object are sought. Results concerning models of extensions E/A are reviewed, where A is a perfect Dedekind ring and E a regular extension of genus O of the field of fractions of A and their connections with orders in quaternion algebras. If M and M prime are two relatively minimal models of E/A, then there is a sequence of relatively minimal models M sub O = M, M sub 1, ..., M sub n = M prime such that M sub i + 1 is an elementary transform of M sub i for O < or equal i < n. Author (ESA)

N81-27861# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.

SOME PROBLEMS IN CONNECTION WITH THE INCOMPLETE GAMMA FUNCTIONS

N. M. Temme Aug. 1980 17 p refs

(MC-TW-205/80) Avail: NTIS HC A02/MF A01

Three problems are examined. The first is related to the eCs) = 1/Gamma function (s+1) integral sign, lower limits, upper limit infinity to the power of s, e to the power of minus t dt function which is expressed in terms of Q(ax) as Q(s+1,s). The convexity of e(s) is proved. The second relates to the Q sub n (x) = c to the minus x (1+x+...x to the nth/n factorial sign) function n = 0,1....It is shown that if x = ssubn is the solution of the equation (Q sub n (x) = 1/2), then ssubn - n approaches 2/3 as n tends to the limit infinity. The third relates to the expressions asubn = n-1/n + n-1) (n-2)/n squared.....n to the n-1/(n+1).....(2n-1). It is proved that for all n > or = 1,0 < bsubn-asubn <1 and that the limit as n tends to the limit infinity (b sub n-a sub n)=2/3 and b sub n-a sub n-2/3 = 0(1/n). Some of the solutions are obtained by extending previously obtained uniform asymptotic expansions to treat the problems. Author (ESA)

N81-27862# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.

ON THE VAN DER POL RELAXATION OSCILLATOR WITH A SINUSOIDAL FORCING TERM

J. Grasman Sep. 1980 15 p refs

(MC-TW-207/80) Avail: NTIS HC A02/MF A01

Asymptotic approximations of subharmonic solutions of the periodically forced Van der Pol relaxation oscillator are constructed with singular perturbation techniques. These approximations are locally valid and can take the form of a two variable expansion in one region and a boundary layer type of solution in another region. Integration constants are determined by averaging and matching conditions. The construction of the approximations brings about certain restricting conditions on the amplitude of the forcing term. Author (ESA)

N81-27863# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.

A VARIATION-OF-CONSTANTS FORMULA FOR NONLINEAR VOLTERRA INTEGRAL EQUATIONS OF CONVOLUTION TYPE

O. Diekmann and S. A. vanGils Sep. 1980 13 p refs Presented at Conf. on Nonlinear Differential Equations: Invariance, Stability and Bifurcation, Trento, Italy, May 1980 Submitted for publication

(MC-TW-206/80) Avail: NTIS HC A02/MF A01

With a Volterra integral equation of the convolution type, it is possible to associate a semigroup of operators acting on a space of forcing functions. Within this context, a variation-of-constants formula is derived for a certain class of nonlinear equations. It is indicated how it is possible to extend the results to other classes by considering a special equation from mathematical epidemiology. Author (ESA)

N81-27864# Research Inst. of National Defence, Stockholm (Sweden).

A GENERAL METHOD OF APPROXIMATION ASSOCIATED WITH BERNSTEIN POLYNOMIALS

Staffan Wrigge Dec. 1980 48 p refs

(FOA-C-10170-M8) Avail: NTIS HC A03/MF A01

A general method of function approximation is presented. The method uses the fact that a Bernstein polynomial Bn(x.f) converges uniformly towards f(x) for all x in the interval (0,1), given a continuous function f(x) in that interval. It is shown that accuracy is good in comparison with comparable published methods. The measuring of the distance between the functions and their approximations is discussed, and the practical procedure is illustrated using computer calculation examples. Tables of Bernstein coefficients, matrix inversions for calculating linear system coefficients in error computation, and example results showing exact and approximative values of a gamma function are included. Author (ESA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N81-27865*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

THE THEORY AND PRACTICE OF ESTIMATING THE ACCURACY OF DYNAMIC FLIGHT-DETERMINED COEFFICIENTS Final Report

Richard E. Maine and Kenneth W. Iliff Jul. 1981 63 p refs

(NASA-RP-1077; H-1128) Avail: NTIS HC A04/MF A01 CSCL 12A

Means of assessing the accuracy of maximum likelihood parameter estimates obtained from dynamic flight data are discussed. The most commonly used analytical predictors of accuracy are derived and compared from both statistical and simplified geometrics standpoints. The accuracy predictions are evaluated with real and simulated data, with an emphasis on practical considerations, such as modeling error. Improved computations of the Cramer-Rao bound to correct large discrepancies due to colored noise and modeling error are presented. The corrected Cramer-Rao bound is shown to be the best available analytical predictor of accuracy, and several practical examples of the use of the Cramer-Rao bound are given. Engineering judgement, aided by such analytical tools, is the final arbiter of accuracy estimation. Author

N81-27866# Maryland Univ., College Park. Dept. of Computer Sciences.

ON THE OPTIMALITY OF SEMIDYNAMIC ROUTING SCHEMES Interim Report

Ashok K. Agrawala and Satish K. Tripathi Nov. 1980 9 p refs

(Grant AF-AFOSR-3654-78; AF Proj. 2304)

(AD-A099976; TR-975; AFOSR-81-0487TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Semidynamic routing schemes perform better than stochastic schemes. Recently some semidynamic schemes based on the best stochastic schemes have been studied. In this paper, using a simple example, we show that devising semidynamic schemes from stochastic rules may not yield the best performance. Author (GRA)

N81-27867# Naval Research Lab., Washington, D. C.

GENERATION OF A MULTIVARIATE DISTRIBUTION FOR SPECIFIED UNIVARIATE MARGINALS AND COVARIANCE STRUCTURE Final Report

I. R. Goodman 28 May 1981 28 p refs

(RR0140241)

(AD-A099578; NRL-MR-4425) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper addresses the problem of determining and generating outcomes for a joint multivariate distribution having specified arbitrary marginal distributions and correlation structure. In addition, a new technique is developed which generates outcome for essentially any given multivariate random variable from a more conveniently realizable random variable. This generalizes in a natural way the well known univariate transformation of probability sampling technique. Author (GRA)

N81-27868# Naval Underwater Systems Center, New London, Conn. Surface Ship Sonar Dept.

PROBABILITY DISTRIBUTION OF ARRAY RESPONSE FOR

RANDOMLY PERTURBED ELEMENT GAINS
Albert H. Nuttall 20 May 1981 53 p refs
(ZR0000101)
(AD-A099811; NUSC-TR-5687A) Avail: NTIS HC A04/MF A01 CSCL 12/1

The characteristics function of the power response of an array subject to Gaussian perturbations in its element gains is derived. From this expression, the cumulants are derived, and the mean and standard deviation are plotted for a wide variety of arrays and weights, including linear arrays or planar arrays, and Dolph-Chebyshev, Hanning, or uniform weights. Rules of thumb for the average attainable deep side lobe level and its variation are presented. Expressions for non-Gaussian element perturbations are also derived. Author (GRA)

N81-27869# Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, Md.
THE PROBABILITY OF HITTING A POLYGONAL TARGET
Arthur D. Groves Apr. 1981 20 p
(DA Proj. 1R7-65706-M-541)
(AD-A099818; AMSAA-TR-330) Avail: NTIS HC A02/MF A01 CSCL 12/1

For mathematical convenience, military targets are generally represented by simple geometric shapes (circles, elipses and rectangles) in performance models which require the computation of hit probability. A much more realistic representation of target shape would frequently be possible through the use of a polygon. This report derives a simple algorithm for the computation of the probability of hitting a general n-sided polygon.
Author (GRA)

N81-27870# California Univ., Berkeley. Operations Research Center.
A STOCHASTIC THEORY OF PRODUCTION CORRESPONDENCES
King-Tim Mak Mar. 1981 118 p refs
(Contract N00014-76-C-0134; Grant NSF MCS-77-16054; NR Proj. 047-033)
(AD-A099813; ORC-81-6) Avail: NTIS HC A06/MF A01 CSCL 12/1

An axiomatic model of production technology under uncertainty is formulated from a purely technical point of view as a generalization of Shephard (1970-a) and Shephard/Fare's (1980) framework for a general theory production. The uncertain technical feasibility of production is characterized by inversely related stochastic input and output correspondences. This model of technology is then synthesized with a Radner (1968) type model of information for a formulation of production policies. This synthesis is used to give formulations of laws of returns under uncertainty. Finally, a generalized notion of homothetic production correspondences is developed to give special-structured stochastic production models which allow explicit consideration of optimal production policies. Author (GRA)

N81-27871# California Univ., Berkeley. Operations Research Center.
COHERENT ASSESSMENT OF SUBJECTIVE PROBABILITY
Robert F. Nau Mar. 1981 51 p refs
(Contract N00014-75-C-0781; Grant AF-AFOSR-3179-77)
(AD-A099722; ORC-81-5) Avail: NTIS HC A04/MF A01 CSCL 12/1

This report discusses the role of coherence considerations in the definition and measurement of subjective probability. A general version of De Finetti's coherence theorem--that either a set of betting probabilities obeys the laws of probability or else a sure win is possible for the better, is proved, using a variant of Farka's Lemma. This theorem provides the basis for several admissibility theorems for scoring-rule probabilities, under a generalization of scoring rules suggested by Lindley. Linear programming methods for identifying and reconciling incoherence are discussed, and a comparison is made with Bayesian reconciliation methods. Author (GRA)

N81-27872# Cornell Univ., Ithaca, N. Y. School of Operations Research and Industrial Engineering.
CONDITIONS UNDER WHICH E (N1)= INFINITY FOR TONGS ADAPTIVE SOLUTION TO RANKING AND SELECTION PROBLEMS
Charles E. McCulloch Sep. 1980 10 p refs
(Contracts DAAG29-80-C-0036; N00014-75-C-0586)
(AD-A099821; TR-480) Avail: NTIS HC A02/MF A01 CSCL 12/1

Tong proposed an adaptive approach as an alternative to the classical indifference-zone formulation of the problems of ranking and selection. With a fixed pre-selected gamma* (1/k < gamma* < 1), his procedure calls for the termination of vector-at-a-time sampling when the estimated probability of a correct selection exceeds gamma* for the first time. The purpose of this note is to show that for the case of two normal populations with common known variance, the expected number of vector-observations required by Tong's procedure to terminate sampling approaches infinity as the two population means approach equality for gamma* > or = approx. 0.8413. This phenomena presumably also persists if the two largest of k > or = 3 population means approach equality. Since in the typical ranking and selection setting it usually is assumed that that experimenter has no knowledge concerning the differences between the population means, the experimenter who uses Tong's procedure clearly does so at his own risk. Author (GRA)

N81-27873# Cornell Univ., Ithaca, N. Y. School of Operations Research and Industrial Engineering.
TABLES OF OPTIMAL ALLOCATIONS OF OBSERVATIONS FOR COMPARING TREATMENTS WITH A CONTROL
Robert E. Bechhofer and Ajit C. Tamhane (Northwestern Univ.) Jan. 1981 27 p refs
(Contracts DAAG29-80-C-0036; N00014-75-C-0586)
(AD-A099822; TR-489) Avail: NTIS HC A03/MF A01 CSCL 12/1

The problem under consideration is that of estimating simultaneously the differences between the means of p > or = 2 test treatments and the mean of a control treatment when the population variances of all p + 1 treatments are known. Tables are given which permit the experimenter to find the minimal total number of experimental units, and the optimal allocation of these units among the P + 1 treatments, in order to make one-sided or two-sided confidence interval estimates of the differences of interest. These intervals achieve a specified joint confidence coefficient 1-alpha for a specified allowance or yardstick associated with the common width of the intervals. The computations for these tables are based on the results of Bechhofer (1969) for one-sided comparisons, and Bechhofer and and Nocturne (1972) for two-sided comparisons. Author (GRA)

N81-27874# Cornell Univ., Ithaca, N. Y. School of Operations Research and Industrial Engineering.
MULTIPLE COMPARISONS FOR ORTHOGONAL CONTRASTS: EXAMPLES AND TABLES
Robert E. Bechhofer and Charles W. Dunnett Mar. 1981 32 p refs
(AD-A099823; TR-495) Avail: NTIS HC A03/MF A01 CSCL 12/1

In many experimental situations, the pertinent inferences are made on the basis of orthogonal contrasts among the treatment means (as in 2 to the nth power factorial experiments). In this setting a particularly useful form of inference is one involving multiple comparisons. The present paper describes situations in which such inferences are meaningful, gives examples of their use, and provides an extensive set of tables of constants needed to implement such multiple comparison procedures. The procedures can also be used for statistically legitimate data snooping to help decide which contrasts within a specified set warrant further study. GRA

N81-27875# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
ON THE PROBLEM OF FINDING A BEST POPULATION WITH RESPECT TO A CONTROL IN TWO STAGES
Shanti S. Gupta and Klaus-J. Miescke Mar. 1981 30 p refs
(Contract N00014-75-C-0455)
(AD-A099613; MIMEOGRAPH-SER-81-6) Avail: NTIS HC A03/MF A01 CSCL 12/1

Let pi1,..., pi(k) be given populations associated with unknown real parameters theta(l),...,theta(i) is assumed to be 'good' if theta(i) = theta(O), where theta(O) epsilon R is a given control value, i = 1,...,k. The goal is to find the 'best' population (i.e. that

one with the largest parameter), if it is 'good', in 2 stages with screening out 'bad' populations in the first stage. Consideration is restricted to permutation invariant procedures. It is shown that under MLR and a general invariant loss structure the natural final decisions are optimum. More generally an extension of the 'Bahadur-Goodman Theorem' to sequential settings (with and without relation to a control) is derived. If the loss structure consists of the cost for sampling plus the loss for final decision, it is shown that for every symmetric prior there exists a Bayes procedure which selects at the first stage populations according to the largest observations. Natural procedures, which screen out with the UMP test for H: theta - theta(O) versus K: theta = theta(O) at fixed level alpha, are considered. As an example, all results are studied in the special case of normal populations with unknown means and a common known variance.
Author (GRA)

N81-27876# Sandia Labs., Albuquerque, N. Mex. Safeguards Methodology Development Div.
DIGITAL SIMULATION AND MODELING OF NONLINEAR STOCHASTIC SYSTEMS
J. Mark Richardson and James R. Rowland Apr. 1981 25 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-2080) Avail: NTIS HC A02/MF A01

Numerical integration algorithms are shown not only to provide different solutions for the same stochastic system but also to correspond to different stochastic integral definitions. These correspondences are proved by considering first and second moments of solutions that result from different integration algorithms and then comparing the moments to those arising from various stochastic integral definitions. This algorithms dependence of solutions is in sharp contrast to the deterministic and linear stochastic cases in which unique solutions are determined by any convergent numerical algorithm. Consequences of the relationship between stochastic solutions and simulation procedures are presented for a nonlinear filtering example. Monte Carlo simulations and statistical tests are applied to the example to illustrate the determining role which computational procedures play in generating solutions. DOE

N81-27877# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
A CONFIDENCE PROCEDURE BASED ON FISHER'S PERMUTATION TEST
Martin Haernqvist 1980 16 p refs
(CTH-MATH-1980-11) Avail: NTIS HC A02/MF A01

A confidence procedure that corresponds to Fisher's permutation test is developed in the two-sample and one-sample cases. The corresponding point estimates are also given. A computational algorithm, either for obtaining the confidence interval or merely for calculating the exact significance probability in Fisher's permutation test, is explained. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N81-27878# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
EXTENDED VALIDITY OF LINEARIZED KINEMATIC MODEL FOR OPTIMAL MISSILE AVOIDANCE
Y. Rotsztein and J. Shinar Mar. 1980 44 p refs Presented at the 22nd Israel Ann. Conf. on Aviation and Astronautics, Haifa, Israel, 12-13 March 1980
(Contract F49620-79-C-0135)
(TAE-398) Avail: NTIS HC A03/MF A01

Optimal missile avoidance is analyzed with a two dimensional linearized kinematic model. It is shown that inclusion of a control-effort penalization term in the payoff function leads to extend the domain of validity of the trajectory linearization. The required values of the weighting coefficient of the control penalization and the resulting loss in the optimal miss distance are evaluated. A recursive algorithm for the numerical solution of the modified optimal avoidance problem is presented. The optimal solutions obtained for the linearized kinematical model are compared to results of nonlinear simulation. M.G.

N81-27879# Desmatics, Inc., State College, Pa.
THE PROBLEM OF EXPERIMENTAL DESIGN IN SIMULATION
Dennis E. Smith and Carl A. Mauro May 1981 20 p refs Presented at the CORS-TIMS-ORSA Joint Natl. Meeting, Toronto, 3-6 May 1981
(Contract N00014-79-C-0650; NR Proj. 274-317)
(AD-A099703; TR-113-4) Avail: NTIS HC A02/MF A01 CSCL 14/2

In many cases, a simulation study may be viewed as an experimental situation in which a number of factors (independent variables) are to be investigated. However, standard experimental design techniques often require more simulation runs than are available to the simulation user. In general, the primary problem of experimental design in simulation can be succinctly summarized as too many factors and too few runs. A discussion of this problem is presented in this report. Three possible two-stage strategies for attacking the problem are considered, and performance measures with which to judge the strategies are described. Author (GRA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N81-27880# Maryland Univ., College Park. Computer Vision Lab.
SOME RESULTS ON FUZZY (DIGITAL) CONVEXITY Interim Report
Ludvik Janos and Azriel Rosenfeld Mar. 1981 16 p refs
(Grant AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A100003; TR-1035; AFOSR-81-0469TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The definition of fuzzy convexity is reviewed, and some results on projections of convex and fuzzy convex sets are established. Digital fuzzy convexity is defined, and relationships among alternative definitions are investigated. Author (GRA)

N81-27881# California Univ., Livermore. Lawrence Livermore Lab.
EXISTENCE OF A LAST INVARIANT OF CONSERVATIVE MOTION
Lawrence S. Hall 6 Mar. 1981 23 p refs
(Contract W-7405-eng-48)
(UCID-18980) Avail: NTIS HC A02/MF A01

An attempt is made to explain the nature of the class of conservative systems for which there is no overlapping of resonances. S.F.

N81-27882# Fondazione Ugo Bordoni, Rome (Italy).
ON THE SUCCESSIVE POWERS OF PARTICULAR MATRICES OF ORDER N, WITH N NON-ZERO ELEMENTS [SULLE POTENZE SUCCESSIVE DI PARTICOLARI MATRICI DI ORDINE N, CON N ELEMENTI NON NULLI]
Piero Filipponi Feb. 1980 15 p refs In ITALIAN
(FUB-3-1980) Avail: NTIS HC A02/MF A01

Simple algorithms are given for the calculation of successive powers of dispersed matrices presenting a nonzero element in each line and column, and whose nonzero elements can assume any value. The class F of matrices is defined, as are certain properties of successive powers of F and the particular structure of F. A practical example is given. The auxiliary matrix A is defined and its employment in the calculation of F is given. The calculation of the power of F to whole negative exponents is demonstrated, the eigenvalue of F determined, and the determinant of F is calculated. Transl. by J.D.H.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

No abstracts in this category.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N81-27883*# National Aeronautics and Space Administration, Washington, D. C.

AVIATION NOISE OVERLOAD IN THE IMMEDIATE PROXIMITY OF THE WARSAW-OKECIE AIRPORT

Zbigniew Koszarny and Stefan Maziarka May 1981 14 p refs Transl. into ENGLISH from Rocznik Panstwowego Zakladu Hyg. (Poland), v. 26, no. 1, 1975 p 1-10 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-75892) Avail: NTIS HC A02/MF A01 CSCL 20A

The results are presented for investigations on noise overload around the Warszawa-Okecie airport on persons inhabiting the area where it exceeds 100 dB for a single aircraft flight. Of 256 subjects, 91.1 percent complained about aircraft noise overload. In the population studied considerable differences were noted respecting the subjective sensitivity scale. Statistical analysis showed numerous correlations between the individual noise sensitivity threshold and the subject's state of health, age, sex, type of work, etc. At the same time investigations demonstrated various forms and levels of disturbance in the organism for individual subjects and groups. The most frequent complaint was chronic fatigue (68.1 percent), followed by nervousness (36.6 percent), frequent headaches (36.2 percent), hearing disturbances (30.0 percent) and sleep disorders (23.9 percent).

Author

N81-27884*# Syracuse Univ., N. Y. Dept. of Mechanical and Aerospace Engineering.

AEROACOUSTICS OF A POROUS PLUG JET NOISE SUPPRESSOR Semiannual Status Report, 1 Jan. - 30 Jun. 1981

D. S. Dosanjh Jul. 1981 62 p refs

(Contract NAG1-129)

(NASA-CR-164549; SASR-1) Avail: NTIS HC A04/MF A01 CSCL 20A

The aeroacoustics of a porous plug jet noise suppressor was investigated. The predicted flow features of isentropic plug nozzles for different pressure ratios or exit flow Mach numbers, throat areas, ratios of the plug to annular nozzle radii, mass flow rates and the available run times possible with the existing compressed air supply system, are compiled. The dimensions and the coordinates of the contour of typical isentropic external expansion plugs with different exit flow Mach numbers are listed. Design details of the experimental facility and the plug nozzle selected for experimental aeroacoustic studies are reported. The analytical flow prediction by method of characteristics of a conical porous plug nozzles is initiated. The role of the shape, size, and porosity of the plug surface in achieving over a perforated conical plug a nearly isentropic shockfree supersonic flow field which is closely similar to the flow field of a contoured isentropic plug nozzle is examined. E.A.K.

N81-27885*# Continuum Dynamics, Inc., Princeton, N. J.

COMPUTING AERODYNAMIC SOUND USING ADVANCED STATISTICAL TURBULENCE THEORIES

A. M. Hecht, M. E. Teske, and A. J. Bilanin Apr. 1981 72 p refs

(Contract NAS1-15937)

(NASA-CR-165697) Avail: NTIS HC A04/MF A01 CSCL 20A

It is noted that the calculation of turbulence-generated aerodynamic sound requires knowledge of the spatial and temporal variation of Q sub ij (xi sub l, tau), the two-point, two-time turbulent velocity correlations. A technique is presented to obtain an approximate form of these correlations based on closure of the Reynolds stress equations by modeling of higher order terms. The governing equations for Q sub ij are first developed for a general flow. The case of homogeneous, stationary turbulence in a unidirectional constant shear mean flow is then assumed. The required closure form for Q sub ij is selected which is capable of qualitatively reproducing experimentally observed behavior. This form contains separation time dependent scale factors as parameters and depends explicitly on spatial separation. The approximate forms of Q sub ij are used in the differential equations and integral moments are taken over the spatial domain. The velocity correlations are used in the Lighthill theory of aerodynamic sound by assuming normal joint probability.M.G.

N81-27886*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.

PREDICTION OF SOUND RADIATION FROM DIFFERENT PRACTICAL JET ENGINE INLETS Semiannual Status Report, 1 Dec. 1980 - 30 May 1981

Ben T. Zinn and William L. Meyer 1981 128 p refs

(Grant NAG3-67)

(NASA-CR-164620) Avail: NTIS HC A07/MF A01 CSCL 20A

Computer codes, capable of producing accurate results for nondimensional wave numbers (based on duct radius) of up to 20, were developed and used to generate results for various other inlet configurations. Both reflection coefficients and radiation patterns were calculated by the integral solution procedure for the following five inlet configurations: the NASA Langley Bellmouth, the NASA Lewis JT-15D-1 ground test nacelle, and three hyperbolic inlets of 50, 70, and 90 degrees. Results obtained are compared with results from other experimental and theoretical studies. A.R.H.

N81-27887*# National Aeronautics and Space Administration. Pasadena Office, Calif.

ACOUSTIC SUSPENSION SYSTEM Patent Application

Mark C. Lee, inventor (to NASA) Filed 12 Jun. 1981 13 p (NASA-Case-NPO-15435-1; US-Patent-Appl-SN-272837) Avail: NTIS HC A02/MF A01 CSCL 20A

A device for acoustically supporting small objects under 1 mm diameter, such as hollow glass spheres during processing into nuclear fusion target pellets is described. The acoustic levitation system utilizes single acoustic source and a small reflector to stably levitate an object while the object is processed by coating or heating. The concave acoustic source is located on opposite sides of its axis and vibrates towards and away from a focal point to generate a converging acoustic field. A small reflector is located near the focal point, to create an intense acoustic field that supports a small object near the reflector. The reflector can be located about one half wavelength from the focal point and can be concavely curved to a radius of curvature of about one half the wavelength, to stably support an object one quarter wavelength from the reflector. NASA

N81-27888# Naval Ocean Research and Development Activity, Bay St. Louis, Miss. Ocean Technology Div.

A MOMENTS APPROACH FOR ANALYZING GEOPHYSICAL REFLECTION DATA

Norman H. Gholson and Martin G. Fagot May 1980 45 p refs

(AD-A099816; NORDA-30) Avail: NTIS HC A03/MF A01 CSCL 12/1

This publication presents a new approach developed for analyzing geophysical acoustic reflecting data. The forward problem of estimating source to receiver travel time, and the inverse problem of estimating a sound speed versus depth relationship are addressed using a moments approach. The moments approach provides a simple tool for estimating source to receiver reflection path travel time for a laterally homogeneous medium with an arbitrary sound speed versus depth relationship. The moments approach also provides a useful tool for inverting reflection data to obtain an estimate of the sound speed versus

depth relationship. A nearly closed form technique for estimating a linear sound speed versus depth relationship is presented. Derivation of the moments approach and numerical examples are included. GRA

N81-27889# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
EFFECT OF PROPAGATION DISTANCE ON AIRCRAFT FLYOVER SOUND DURATION
Jerry D. Speakman May 1981 20 p
(AF Proj. 7231)
(AD-A099694; AFAMRL-TR-81-28) Avail: NTIS HC A02/MF A01 CSCL 20/1

In the past, NOISEMAP and other aircraft noise contouring programs incorporating single event, time-integrated measures such as Sound Exposure Level (SEL) or Effective Perceived Noise Level (EPNL) assumed that the sound duration for flyovers doubled for each doubling of the distance between the source and a receiver. This simplifying assumption considers only the losses due to the spherical divergence of a sound wave as it propagates over distance. Mathematically this meant that in calculating SEL or EPNL versus distance functions, a 'duration' term was introduced that was proportional to multiplying the logarithm of the ratio in propagation distances between two points by a coefficient of 10. Controlled level flyover noise tests were conducted on A-10, C-135A, C-141, E-3A, F-5E, F-15 and F-18 aircraft to directly measure sound duration as a function of propagation distance. Data were also acquired during a dedicated series of C-130E actual takeoffs and landings. Our findings show the duration coefficient varies between 5 and 7 for different aircraft types. Clearly the old coefficient of 10 is wrong. Data are included that also show that the sound attenuation mechanisms controlling this duration coefficient are basically independent of the frequency content of the aircraft noise. GRA

N81-27890# Human Engineering Labs., Aberdeen Proving Ground, Md.
THE BACKGROUND AND BASES FOR THE PROPOSED MILITARY STANDARD ON ACOUSTICAL NOISE LIMITS IN HELICOPTERS Final Report
Georges R. Garinther and David C. Hodge Mar. 1981 14 p refs
(AD-A099814; HEL-TM-5-81) Avail: NTIS HC A02/MF A01 CSCL 01/3

A design standard for interior noise of helicopters has been prepared to provide the developer and user with realistic noise limits which consider hearing damage risk, speech intelligibility, mission profile, state-of-the-art in noise reduction, and helicopter weight. The levels selected meet the current hearing conservation limits of the Department of Defense and permit electrically aided sentence intelligibility of 98%. Helicopters below 20,000 pounds are treated separately from those above because of the strong positive relation between internal noise and vehicle gross weight. This standard defines the locations and flight conditions under which noise measurements shall be made for compliance. It also specifies the types of instrumentation and the test procedures to be used to collect interior noise level data. This degree of specificity in the instrumentation and measurements area is intended to insure that data collected by different development and test agencies will be both accurate and consistent. Author (GRA)

N81-27891# Texas Univ. at Arlington. Applied Research Labs.
A SUMMARY OF RECENT RESULTS IN ACOUSTIC BOTTOM INTERACTION RESEARCH Annual Report, 1 Jan. - 31 Dec. 1980
Paul J. Vidmar, Robert A. Koch, James F. Lynch, and Kenneth E. Hawker 24 Mar. 1981 35 p refs
(Contract N00014-78-C-0113)
(AD-A099531; ARL-TR-81-11) Avail: NTIS HC A03/MF A01 CSCL 20/1

This report summarizes research on acoustic interaction with the sea floor carried out during 1980 at Applied Research Laboratories, The University of Texas at Austin. Major topics considered are generic geoacoustic profiles for single layer sediment structures and propagation in a range variable environment. Other topics include the effects of bottom roughness (scattering) and the bottom interaction phase shift.Author (GRA)

N81-27892# National Physical Lab., Teddington (England). Acoustics Unit.
UNCERTAINTIES IN REALIZING THE STANDARD OF SOUND PRESSURE BY THE CLOSED COUPLER RECIPROCITY TECHNIQUE
M. E. Delaney and E. N. Bazley Dec. 1980 62 p refs
(NPL-AC-99; ISSN-0143-7143) Avail: NTIS HC A04/MF A01

The identification of the sources and magnitudes of the uncertainties associated with the determination of the pressure sensitivity of one-inch laboratory standard microphones is discussed in detail. The microphones are calibrated by the closed coupler reciprocity technique. A measurement method designed to achieve an acceptable level of uncertainty is described. The components of systematic and random uncertainties in the 63 Hz to 12.5 kHz range are given. With suitable microphones, the overall systematic uncertainty of calibration is estimated to be less than 0.025 dB at frequencies up to 1 kHz increasing to 0.11 dB at 10 kHz. Author (ESA)

N81-27893# European Space Agency, Paris (France).
OPTIMIZATION OF BARRIERS
Dieter Lohmann, H. Kluge, and K. H. Spiegel Mar. 1981 56 p refs Transl. into ENGLISH of "Zur Optimierung von Schallschutzwaenden" DFVLR, Brunswick Report DFVLR-FB-79-29, Dec. 1978
(ESA-TT-648; DFVLR-FB-79-29) Avail: NTIS HC A04/MF A01

A scale model of a SF6 engine fan installed in an anechoic chamber was used to examine diffraction effects behind sound screens. The screens were 22 mm thick covered with a 5 cm layer of mineral wool on the source side. Test data were stored on a 14 track tape device and later displayed using a real time analyzer after averaging 32 spectra with an absolute bandwidth of 20 Hz and, in the case of the double wall, partially also as third octave spectra. The sound screening effect is found to depend mainly on the directional characteristics of the fan due to the diffraction at the edges of the screen. The sound screen should therefore be dimensioned and positioned so that its edges are not in the region of the maxima of the directional characteristics. Author (ESA)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N81-27894 British Library Lending Div., Boston Spa (England). Article Translating Service.
ABSOLUTE MEASUREMENT OF RATES OF CAPTURE OF NEUTRONS IN 238U AND FISSION IN 239Pu
V. A. Dulin Apr. 1981 7 p refs Transl. into ENGLISH from At. Energ. (USSR), no. 44, 1978 p 528-530
(BLL-RTS-12516) Avail: British Library Lending Div., Boston Spa, England

The absolute rate of capture of neutrons in U-238 was measured in terms of the Np-239 activity found (gamma radiation), using a calibrated Am-243 source to determine the efficiency of gamma recording in the detector. The absolute rate of fission of Pu-239 was determined by means of a fission chamber with a known number of Pu-239 nuclei, and the efficiency of fission fragment recording in the chamber was calculated. A.R.H.

N81-27895# Columbia Univ., New York. Radiation Lab.
THE PHYSICS OF SPIN-POLARIZED ATOMIC VAPORS Final Report, 1 Mar. 1979 - 28 Feb. 1981
William Happer May 1981 10 p refs
(Grant AF-AFOSR-0082-79; AF Proj. 2301)
(AD-A100014; AFOSR-81-0498TR) Avail: NTIS HC A02/MF A01 CSCL 20/10

Spin polarized atomic vapor systems are of considerable interest to the civilian and military sectors of our society because

they can be used to make very precise measurements of time, absolute rotation rates, and electromagnetic fields. Topics studied include: Spin Destruction in Collisions between Alkali Atoms; Light Narrowing of Magnetic Resonance Lines in Dense Alkali Vapors; and The Role of Naxe Molecules in the Spin Relaxation of Optically Pumped Na in Xe Gas. GRA

N81-27896# Utah Univ., Salt Lake City. Dept. of Chemistry.
ENERGETICS OF IONIZATION AND EXCITATION PROCESSES Final Report, 1 Sep. 1977 - 28 Feb. 1981
John P. Simons May 1981 14 p refs
(Contract DAAG29-79-C-0163; Grant DAAG29-77-G-0193)
(AD-A099611; ARO-14343.2-C) Avail: NTIS HC A02/MF A01 CSCL 07/4

We have made significant developments in the area of quantum chemical methodology. The majority of these developments were aimed at providing our group with state-of-the-art tools for use on the difficult chemical problems in which we are interested. Making use of our new theoretical tools, we have studied the electronic properties (stability, bonding character, shapes) of the ground and excited electronic states of several classes of molecular ions and novel reactive intermediates. GRA

N81-27897# Sandia Labs., Albuquerque, N. Mex. Particle Beam Fusion Research Dept.
PROTON CURRENT MEASUREMENTS USING THE PROMPT GAMMA RAY DIAGNOSTIC TECHNIQUE
R. J. Leeper, E. J. T. Burns, D. J. Johnson, and W. M. McMurtry 1981 9 p refs Presented at the Workshop on Meas. of Elect. Quantities in Pulsed Power Systems, Boulder, Colo., 2 Mar. 1981
(Contract DE-AC04-76DP-00789)
(SAND-80-2561C; CONF-810325-2) Avail: NTIS HC A02/MF A01

Prompt gamma ray signals from the nuclear reaction Li-7(p,gamma)Be-8 were used to make time resolved proton current measurements. The time integrated proton current was measured using gamma activation of copper via the reaction Cu-63(gamma,n)Cu-62(beta +). The positron activity of the copper sample was measured by coincidence counting techniques. The time history of the prompt gamma production was measured. The normalization of the prompt gamma time history data with the total time integrated proton current measurement yielded the absolute time resolved proton current on target. DOE

N81-27898# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Munich (West Germany). Inst. fuer Festkoerpertechnologie.
HIGH ENERGY ELECTRON IRRADIATION TO ADJUST MINORITY CARRIER LIFETIMES IN PRODUCTION Final Report
Peter Eichinger and Jens Weidhaas Bonn Bundesministerium fuer Forschung und Technologie Nov. 1980 33 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-087; ISSN-0340-7608) Avail: NTIS HC A03/MF A01

Different types of thyristors, triacs and diodes were irradiated with high energy electrons from a Van de Graaf accelerator. Electron irradiation leads to a better reproductibility and a higher degree of homogeneity for minority carrier lifetimes than gold diffusion techniques. The lateral spread in lifetimes after local irradiation through masks was investigated. The results show a significant lateral spread in the lifetime profile specially for high electron energies and doses (energy range 1 to 2.5 Mev, dose range 10 to the 13 power to 10 to the 16 power electrons/cm squared). The results demonstrate the suitability of this technique. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N81-27899*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OPTICAL-MODEL ABRASION CROSS SECTIONS FOR HIGH-ENERGY HEAVY IONS
Lawrence W. Townsend Jul. 1981 18 p refs
(NASA-TP-1893; L-14554) Avail: NTIS HC A02/MF A01 CSCL 20H

Within the context of eikonal scattering theory, a generalized optical model potential approximation to the nucleus-nucleus multiple scattering series is used in an abrasion-ablation collision model to predict abrasion cross sections for relativistic projectile heavy ions. Unlike the optical limit of Glauber theory, which cannot be used for very light nuclei, the abrasion formalism is valid for any projectile target combination at any incident kinetic energy for which eikonal scattering theory can be utilized. Results are compared with experimental results and predictions from Glauber theory. Author

N81-27900# Sandia Labs., Albuquerque, N. Mex.
HIGH-INTENSITY ION ACCELERATORS FOR INERTIAL FUSION
S. Humphries, Jr., T. R. Lockner, and J. R. Freeman 1981 3 p refs Presented at Particle Accelerator Conf., Washington, D.C., 11 Mar. 1981
(Contract DE-AC04-76DP-00789)
(SAND-80-2446C; CONF-810314-16) Avail: NTIS HC A02/MF A01

Accelerator systems capable of driving inertial fusion targets are described. They are based on linear induction accelerator technology coupled with new methods of beam transport using electron neutralization of ion space charge. The resulting accelerators are modular and relatively compact. DOE

N81-27901# Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
ALTERNATIVES FOR LONG-TERM MANAGEMENT OF TRANSURANIC WASTE AT THE SAVANNAH RIVER PLANT
O. A. Towler, Jr. and G. F. Molen 1981 16 p refs Presented at the Waste Management Symp., Tucson, Ariz., 23-26 Feb. 1981 Submitted for publication
(Contract DE-AC09-76SR-00001)
(DP-MS-80-77) Avail: NTIS HC A02/MF A01

The six alternatives are proposed which consider the effects of making no decision (alternative 1), delaying a decision for up to 100 years (alternatives 2 and 3), or taking significant action (alternatives 4, 5, or 6). Alternative 4 exhibits intermediate cost and risk values, and indicates good agreement with ideal disposal characteristics. Alternative 6, which is comparable to alternative 4 in risk and disposal characteristics, would require a large single outlay of capital funds, whereas funds for alternative 4 could be staged. The cases described, excluding the no action case, represent the better alternatives of the 34 that were studied. Their costs range from 80 to 270 million dollars, while the sum of the population risk and worker dose ranges from 95 to 13,800 man-rem. The naturally occurring dose from cosmic rays and terrestrial activity to the same population over the same period is many times larger. DOE

N81-27902# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
SMALL-SCALE INTEGRATED DEMONSTRATION OF HIGH-LEVEL RADIOACTIVE WASTE PROCESSING AND VITRIFICATION USING ACTUAL SRP WASTE
G. B. Woolsey, P. K. Baumgarten, R. E. Eibling, and R. B. Ferguson 1981 14 p refs Presented at the ANS Waste Management Conf., Tucson, Ariz., 23-26 Feb. 1981 Submitted for publication
(Contract DE-AC09-76SR-00001)
(DP-MS-81-4; CONF-810217-9) Avail: NTIS HC A02/MF A01

A small-scale pilot plant for chemical processing and vitrification of actual high level waste is discussed. This fully integrated facility is constructed in six shielded cells and has eight major unit operations. Equipment performance and processing characteristics of the unit operations are reported. DOE

N81-27903# Analytic Sciences Corp., Reading, Mass.
SELECTION OF CONTAINMENT SYSTEMS FOR COMMERCIAL HIGH LEVEL RADIOACTIVE WASTE MANAGEMENT
M. F. Kaplan, M. S. Giuffre, and J. W. Bartlett May 1981 43 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3803) Avail: NTIS HC A03/MF A01

The geologic and engineered barriers in repositories in different geologic media, such as salt and granite, play very different roles in preserving long term containment. There is no common engineered waste package that is suitable for disposal in all geologic media; each package must be tailored to the specific repository system. The need to make the waste package specific to the repository system leads to the key elements of waste management containment strategy: perform final packaging at the disposal site; and deliver to the site a waste that is in a form suitable for disposal and in a container that is appropriate for the process that produced the waste form; satisfactory for transport; and suitable as the common basis for custom tailoring the waste package for any repository system. Mild carbon steel is a container material expected to meet these requirements.
DOE

N81-27904# Kaiser Engineers, Oakland, Calif.
FINITE-LENGTH LINE SOURCE SUPERPOSITION MODEL (FLLSSM)
Mar. 1980 103 p ref Sponsored in cooperation with Battelle Office of Nuclear Waste Isolation
(Contract DE-AC06-76RL-01830)
(ONWI-94) Avail: NTIS HC A06/MF A01

A linearized thermal conduction model was developed to economically determine media temperatures in geologic repositories for nuclear wastes. Individual canisters containing either high level waste or spent fuel assemblies were represented as finite length line sources in a continuous media. The combined effects of multiple canisters in a representative storage pattern were established at selected points of interest by superposition of the temperature rises calculated for each canister. The methodology is outlined and the computer code FLLSSM which performs required numerical integrations and superposition operations is described.
GRA

N81-27905# Los Alamos Scientific Lab., N. Mex.
ACCEPTABILITY OF REACTORS IN SPACE
David Buden Apr. 1981 29 p
(Contract W-7405-eng-36)
(LA-8724-MS) Avail: NTIS HC A03/MF A01

Reactors are the key to our future expansion into space. However, there has been some confusion in the public as to whether they are a safe and acceptable technology for use in space. The answer to these questions is explored. The US position is that when reactors are the preferred technical choice, that they can be used safely. In fact, it does not appear that reactors add measurably to the risk associated with the space transportation system.
DOE

N81-27906# Radiation Policy Council, Washington, D.C.
REPORT OF THE TASK FORCE ON LOW-LEVEL RADIOACTIVE WASTE
15 Aug. 1980 39 p refs
(PB81-166274; RPC-80-004) Avail: NTIS HC A03/MF A01 CSCL 18H

The Radiation Policy Council formed a Task Force in May 1980 to consider the problems associated with low-level radioactive waste disposal. Two major objectives were developed by the Task Force: (1) to recommend Federal policy for improving coordination and implementation of Federal and non-Federal programs established to obtain slutions to existing low-level waste disposal problems; and (2) to recommend Federal policy for disposal of low-level waste containing minimal activity for which alternative disposal methods to existing shallow land burial practices may be acceptable for protecting the public health.
GRA

74 OPTICS

Includes light phenomena.

N81-27907*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INFRARED RADIATIVE TRANSFER THROUGH A REGULAR ARRAY OF CUBOIDAL CLOUDS
Harshvardhan and James A. Weinman May 1981 31 p refs Submitted for publication
(Contract NAS5-26463)
(NASA-TM-82123) Avail: NTIS HC A03/MF A01 CSCL 20F

Infrared radiative transfer through a regular array of cuboidal clouds is studied and the interaction of the sides of the clouds with each other and the ground is considered. The theory is developed for black clouds and is extended to scattering clouds using a variable azimuth two-stream approximation. It is shown that geometrical considerations often dominate over the microphysical aspects of radiative transfer through the clouds. For example, the difference in simulated 10 micron brightness temperature between black isothermal cubic clouds and cubic clouds of optical depth 10, is less than 2 deg for zenith angles less than 50 deg for all cloud fractions when viewed parallel to the array. The results show that serious errors are made in flux and cooling rate computations if broken clouds are modeled as planiform. Radiances computed by the usual practice of area-weighting cloudy and clear sky radiances are in error by 2 to 8 K in brightness temperature for cubic clouds over a wide range of cloud fractions and zenith angles. It is also shown that the lapse rate does not markedly affect the exiting radiances for cuboidal clouds of unit aspect ratio and optical depth 10.
M.G.

N81-27908# Kollmorgen Corp., Wallingford, Conn. INTOP Div.
MM&T: PRECISION MACHINING OF OPTICAL COMPONENTS Interim Report, Jul. 1979 - Sep. 1980
Arthur E. Hess and Gordon J. Watt Redstone Arsenal, Ala. Army Missile Command Feb. 1981 87 p
(Contract DAAK40-79-C-0255)
(AD-A099322; PMC-006-1) Avail: NTIS HC A05/MF A01 CSCL 20/6

This first interim technical report describes the results of the Basic Effort Contract whose purpose is to establish a commercial manufacturing base for cost-effective production of Army high energy laser and infrared optics and optical support items for Army systems applications. The specification for machinery to manufacture these elements, metrology to measure the components and a facility to house this equipment is presented. A calculation for the return in investment forms part of this report.
Author (GRA)

N81-27909# Geo-Centers, Inc., Newton, Mass.
APPLICATION OF OPTICAL FIBERS TO DNA'S TESTING PROGRAM Final Report, 1 Nov. 1978 - 1 Jul. 1980
Thomas C. Maguire and Louis Isaacson 15 Oct. 1980 71 p refs
(Contract DNA001-79-C-0064; DNA Proj. NWET-J11AAXAX013)
(AD-A099408; GC-TR-80-1041; DNA-5478F) Avail: NTIS HC A04/MF A01 CSCL 20/6

Recent advances in the field of fiber optics communications and the development of fiber optic cabling systems represent a technological breakthrough that offers significant advantages over conventional coaxial cabling systems. The advantages of fiber optic systems include lightweight, wide bandwidth, freedom from electromagnetic interference (EMI) and groundloops, and immunity to crosstalk and short circuit loading. Different applications capitalize on those advantages most attractive to the user. The application of fiber optics to nuclear weapons effects tests sponsored by the Defense Nuclear Agency (DNA) is the topic of this report. Since 1977, experiments utilizing fiber optics have been fielded in underground nuclear tests. Early applications involved experiments designed to characterize fibers in the underground testing environment. The success of these early measurements has developed confidence in fibers to the point

of fielding non-redundant fiber optic links, thus, taking full advantage of their useful characteristics. The encouraging results of testing fiber optic systems to date certainly justifies the continued interest in their use in underground nuclear testing and other applications involving severe environments. The all-dielectric construction of fiber cables makes them lightweight and eliminates many grounding and shielding problems. The wide bandwidth of the fibers enhances the multiplexing capabilities making it possible to reduce the total number of cables. GRA

N81-27910# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.

OPTOACOUSTIC SPECTROSCOPY Final Report

C. Forbes Dewey, Jr. Apr. 1980 114 p refs

(Contract F49620-79-C-0087; AF Proj. 2301)

(AD-A100016; AFOSR-81-0500TR) Avail: NTIS HC A06/MF A01 CSCL 20/6

The objective of this program is to develop improved spectroscopic methods for investigating the absorption of gases in the infrared region of the spectrum. During the contract year covered by this report, we were successful in achieving tunable output from a dye laser pumped by a lead laser, with power levels sufficient to produce tunable infrared radiation by nonlinear mixing. Author (GRA)

N81-27911# Materials Research Labs., Ascot Vale (Australia).

AN INVESTIGATION OF THE RELIABILITY AND SENSITIVITY OF A POLARIZING VISIBILITY METER

R. P. Rubinfeld and S. E. Jenkins Oct. 1980 24 p refs

(AD-A099631; MRL-TN-442) Avail: NTIS HC A02/MF A01 CSCL 20/6

The performance is studied of a 'veiling glare' type of visibility meter in which the ratio of veiling glare to direct viewing is controlled by polarization. It was found that the detectability of standard reference targets was a function of shape as well as contrast. For this reason, and because of better reproducibility, it is recommended that gratings of different contrast rather than small spots be used as standard reference targets. As a result of experience with this instrument it is recommended that the field of view of the field visibility meter which is being designed be increased to at least 25 deg. Author (GRA)

N81-27912# Naval Research Lab., Washington, D. C.

TRANSMITTANCE MEASUREMENTS AT DIRT-III, A PRELIMINARY REPORT

Joseph A. Curcio and Kenneth M. Haught White Sands Missile Range, N. Mex. Army Electronics Research and Development Command Mar. 1981 14 p

(Contract MIPR-ASL-80-8009; DA Proj. 1L6-21111-AH-71)

(AD-A099742; ERADCOM/ASL-CR-81-8009-1) Avail: NTIS HC A02/MF A01 CSCL 17/5

This preliminary report describes the visible and infrared transmittances measured through dust clouds and rain at the Dusty Infrared Test-III (DIRT-III), Fort Polk, Louisiana, April - May 1980. The measurement system was the Naval Research Laboratory (NRL) transmissometer operating at 0.55, 1.06, and 10.37 micrometers. Data were collected through dust clouds produced by various types of munitions and high explosives in the natural soil and tailored soils consisting of sand, silt, clay, and various mixtures. The onset of a rainstorm also provided the opportunity to measure transmittances for varying precipitation rates. GRA

N81-27913# Naval Research Lab., Washington, D. C. Applied Optics Branch.

NRL TRANSMITTANCE MEASUREMENTS AT DIRT-III Final Report

Joseph A. Curcio, Kenneth M. Haught, M. A. Woytko, and C. Gott 2 Jun. 1981 45 p

(AD-A099577; NRL-MR-4519) Avail: NTIS HC A03/MF A01 CSCL 17/5

This is a final report on NRL experiments at the DIRT-III tests at Fort Polk, Louisiana in April - May 1980. Spectral transmission data at 3 wavelengths 0.55 microns, 1.06 microns and 10.4 microns is reported for 27 events in natural soil and various prepared soils. Spectral transmittance of smoke and dust clouds generated by explosive charges was found to be independent of wavelengths in about 50% of the events where useful data was obtained. When the charge was buried in wet natural soil transmittance at 10.4 microns was < transmittance at 0.55 microns . GRA

N81-27914# Army Engineer Topographic Labs., Fort Belvoir, Va.

AN EVALUATION OF REGISTERING IMAGE GRADIENTS WHEN MATCHING INFRARED IMAGERY TO PANCHROMATIC IMAGERY

Michael A. Crombie Jan. 1981 26 p refs

(DA Proj. 4A7-62707-A-855)

(AD-A100037; ETL-0250) Avail: NTIS HC A03/MF A01 CSCL 17/5

A method for calculating corresponding points between infrared imagery and panchromatic imagery using the image gradients and two vector functions is evaluated. The results of the study demonstrate that the method is not satisfactory for mapping. GRA

N81-27915# Texas Technological Univ., Lubbock. Dept. of Electrical Engineering.

WORKSHOP ON FUTURE DIRECTIONS FOR OPTICAL INFORMATION PROCESSING Final Report, 15 Mar. 1980 - 14 Mar. 1981

John F. Walkup and Thomas F. Krile 1 Mar. 1981 156 p refs Conf. held at Lubbock, Tex., 20-22 May 1980

(Contract DAAG29-80-C-0110)

(AD-A099614; ARO-17468.1-EL) Avail: NTIS HC A08/MF A01 CSCL 09/4

This report presents the proceedings of the ARO-sponsored workshop on 'Future Directions for Optical Information Processing' held at Texas Tech University, Lubbock, Texas, on May 20-22, 1980. Ten papers and a panel discussion consider the state-of-the-art and future areas for research in the field of optical information processing. Author (GRA)

N81-27916# Science Applications, Inc., Huntsville, Ala.

MM&T: TESTING OF ELECTRO-OPTIC COMPONENTS Interim Report, 1 Oct. 1979 - 23 May 1980

Paul R. Ashley and Peter D. Poulsen Feb. 1981 68 p refs

(Contract DAAK40-79-C-0276)

(AD-A099757; AD-E950127; SAI-81-819-HU; DRSMI/RH-CR-81-6) Avail: NTIS HC A04/MF A01 CSCL 20/6

Current optical component testing methods were reviewed. Suggested optical testing procedures and standards related to production testing were presented. Optical transfer functions and related applications were reviewed. New approach to production testing of optical components including an analog OFT measurement was laboratory demonstrated. Author (GRA)

N81-27917# Sandia Labs., Albuquerque, N. Mex.

OPTICAL PYROMETRY: EFFECTS OF FINITE OPTICAL BANDWIDTH

M. A. Gusinow and S. B. Margolis Apr. 1981 23 p refs

(Contract DE-AC04-76DP-00789)

(SAND-80-8609) Avail: NTIS HC A02/MF A01

The relationship between the actual temperature of a blackbody and the optically inferred color or brightness temperature depends on the bandwidth and filter response of the optical pyrometric instrument. Lorentzian, Gaussian, and triangular response functions are considered, and the true temperature, observation wavelengths, and bandwidth. It is shown that judicious choices of the observation wavelengths can minimize the discrepancy between actual and inferred temperatures. Alternatively, calculations can be performed which provide an exact correction to the inferred temperature. DOE

N81-27918# Computer Gesellschaft Konstanz m.b.H. (West Germany).

BASIC RESEARCH PROJECTS IN THE FIELD OF OPTICAL CHARACTER RECOGNITION Final Report

Juergen Schuermann, Hans Joachim Held, and Volker Hildebrandt Bonn Bundesministerium fuer Forschung und Technologie Dec. 1980 30 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-DV-80-008; ISSN-0170-9011; BMFT-0812062/DV4906) Avail: NTIS HC A03/MF A01

A classifier concept and classifier adaptation procedure are presented. The indirect polynomial approach is explained. The control of computational effort in the calculation of the classifier is discussed. The multiplication of a set of samples by means of specific stochastic changes in the character features is proposed. The effective organization of the adaptation process and the improvement of the organization of the classification process itself are outlined. In some cases, results lead to a direct improvement in recognition performance. Author (ESA)

N81-27919# Technische Universitaet, Hanover (West Germany). Inst. fuer Messtechnik.
LASER-OPTIC MEASURING SYSTEM FOR TESTING OF MATERIALS Final Report
Dirk Chrestin and Kurt Ringer Bonn Bundesministerium fuer Forschung und Technologie Dec. 1980 60 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie Prepared in cooperation with MFL, Mannheim, West Germany
(BMFT-FB-T-80-145; ISSN-0340-7608) Avail: NTIS HC A04/MF A01

The system quantizes materials specimen deformation during destructive testing. An optical arrangement makes possible detection of elongation and changes in specimen dimensions without contact between the test surface and the measuring apparatus. In the tensile direction, the elongation of the specimen is measured (up to fracture) by following two selected points on the test surface, using a laser-speckle method. The cross sectional area of the specimen and the reduction in area during the test are measured by means of shadow projection onto a multidiode line of high resolution. The complete measuring system consists of the measuring pickup device, with optical and mechanical components which produce an electric signal, and the electronic signal converter with microprocessor for analysis and control purposes. The entire system was tested under actual working conditions, and satisfactory results were obtained.
Author (ESA)

N81-27920# Battelle Inst., Frankfurt am Main (West Germany).
OPTIMIZATION OF THE TECHNOLOGY RELATED TO Ge:Be INFRARED DETECTORS Final Report
U. Brunsmann, J. U. Fischbach, H. Egle, and O. Frenzl Paris ESA Oct. 1980 69 p refs
(Contract ESTEC-3996/79-NL-HP(SC))
(BF-R-64.192-1; ESA-CR(P)-1409) Avail: NTIS HC A04/MF A01

Crystals of Ge Be covering the doping range between 3 x 10 to the 14th power cu cm and 1 x 10 to the 16th power cu cm, were grown. The materials quality was evaluated by Hall effect, resistivity measurements, emission spectroscopy, photoluminescence and Auger analysis. Detector elements were fabricated, using rubbed-in In Ga contacts and boron ion implanted contacts. A beryllium concentration of 8 x 10 to the 14 the power cu cm is found to yield optimum performance. Partial compensation for shallow traps results in an increased breakdown field strength. A maximum current responsitivy of 2 A/W and a minimum noise equivalent power (40 microns 13 Hz, 1.5 K) = 5 x 10 to the minus 16th power W / square root of Hz was obtained at a background photon flux of 3 x 10 to the 8 th power photons per sq cm per sec. Author (ESA)

N81-27921# Plessey Co. Ltd., Towcester (England).
DEVELOPMENT OF AN ACOUSTO-OPTIC (BRAGG CELL) SPECTRUM ANALYSER Final Report
C. Stewart Paris ESA Nov. 1980 56 p refs
(Contracts ESTEC-3961/79-NL-HP(SC); CD.6500667)
(ESA-CR(P)-1413) Avail: NTIS HC A04/MF A01

The approach is based on the interaction between surface acoustic waves and guided optical waves in titanium diffused lithium niobate substrates. Fabrication and assessment of the waveguides and surface wave transducer is described. A modulation transfer function analysis of the device is reported and this description is used to determine the requirements for the Fourier transform lens and output detector array. A conceptual design for a guided wave Bragg cell analyzer is also given.
Author (ESA)

N81-27922# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Experimentelle Atmosphaerenphysik II.
THE HORIZONTAL STANDARD VISIBILITY, DETERMINED BY CONTRAST MEASUREMENTS ON NATURAL TARGETS, AND THE VISUAL VISIBILITY RANGE DURING TEST CAMPAIGNS FOR VISIBILITY
Hans-Eberhard Hoffmann, Ruediger Buell, and Werner Kuehnemann Jun. 1980 55 p refs In GERMAN; ENGLISH summary
(DFVLR-MITT-80-11) Avail: NTIS HC A04/MF A01

The visibility of air and ground targets was synchronously determined with optical measuring equipment. Contrast measurements of natural targets were used to find horizontal standard visibility in three different locations. The extent to which horizontal standard visibility represents visual atmospheric opacity was also examined. Author (ESA)

N81-27130*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROPAGATION PATH LENGTH VARIATIONS DUE TO BENDING OF OPTICAL FIBERS
K. Y. Lau *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 28-32 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 20F

N81-27142*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE EFFECTS OF POINTING ERRORS ON THE PERFORMANCE OF OPTICAL COMMUNICATIONS SYSTEMS
V. A. Vilnrotter *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 136-146 refs (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 20F

N81-27498*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OPTICAL FIBERS FOR THE DISTRIBUTION OF FREQUENCY AND TIMING REFERENCES
George F. Lutes *In* NASA. Goddard Space Flight Center Proc. of the 12th Ann. Precise Time and Time Interval Appl. and Planning Meeting Mar. 1981 p 663-680 refs (For primary document see N81-27467 18-36)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 20F

N81-27996# Kitt Peak National Observatory, Tucson, Ariz.
IMAGING OBSERVATIONS OF OPTICAL EMISSION FROM JETS
H. R. Butcher *In* ESA Opt. Jets in Galaxies Mar. 1981 p 23-24 refs Sponsored by NSF (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

N81-28017# European Southern Observatory, Munich (West Germany).
OPTICAL PROPERTIES OF THE JET IN NGG 5128
I. J. Danziger *In* ESA Opt. Jets in Galaxies Mar. 1981 p 143-144 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N81-27923* Phoenix Corp., McLean, Va.
SPACE PLASMA WAVE EXPERIMENT DEVELOPMENT STUDY Final Report
Paul Rodriguez 31 Aug. 1979 69 p refs Sponsored by NASA
(NASA-CR-166687) Avail: Issuing Activity CSCL 20I

Observations of space plasma waves by the Imp 6 and Ogo 5 spacecraft are reviewed and the requirements for experimental measurements of space plasmas on future spacecraft

are analyzed. Most of the known plasma wave modes are associated with a completely ionized plasma with only one ion species, H(+). Measurements reveal, however, that heavier ions such as He(+) and O(+) may be important to magnetospheric dynamics, and associated plasma waves should be detectable. Plasma waves in a multiple ion plasma occur at very low frequencies and are thus hard to detect with standard plasma wave spectrum analyzers. A fast waveform sampling scheme which should provide good frequency resolution (through a FFT analysis) is suggested which can detect lower frequency plasma waves. The triggering scheme for the waveform analysis is suitable for limited storage capability and telemetry rates. The design is also suitable for detecting impulsive events such as shock waves and electron plasma oscillations. M.G.

N81-27924*# National Aeronautics and Space Administration, Washington, D. C.

THE APPLICATION OF THERMAL PLASMA TO EXTRACTION METALLURGY AND RELATED FIELDS

Kazuo Akashi Jul. 1980 19 p refs Transl. into ENGLISH from Kagaku Kogyo (Japan), Apr. 1980 p 342-347 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75842) Avail: NTIS HC A02/MF A01 CSCL 20I

Various applications of thermal plasma to extraction metallurgy and related fields are surveyed, chiefly on the basis of documents published during the past two or three years. Applications to melting and smelting, to thermal decomposition, to reduction, to manufacturing of inorganic compounds, and to other fields are considered. Author

N81-27925*# National Aeronautics and Space Administration, Washington, D. C.

PLASMA CHEMISTRY AND ITS APPLICATIONS

Keiichiro Hozumi Jul. 1980 15 p refs Transl. into ENGLISH from Kagaku Kogyo (Japan), Apr. 1980 p 337-341 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Kyoto Coll. of Pharmacy, Japan
(NASA-TM-75841) Avail: NTIS HC A02/MF A01 CSCL 20I

The relationship between discharge phenomena and plasma chemistry, as well as the equipment and mechanisms of plasma chemical reactions are described. Various areas in which plasma chemistry is applied are surveyed, such as: manufacturing of semiconductor integrated circuits; synthetic fibers; high polymer materials for medical uses; optical lenses; and membrane filters (reverse penetration films). E.A.K.

N81-27926*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SOLAR-DRIVEN LIQUID METAL MAGNETOHYDRODYNAMIC GENERATOR

Ja H. Lee (Vanderbilt Univ.) and Frank Hohl May 1981 16 p refs
(NASA-TM-81965) Avail: NTIS HC A02/MF A01 CSCL 20I

A solar oven heated by concentrated solar radiation as the heat source of a liquid metal magnetohydrodynamic (LMMHD) power generation system is proposed. The design allows the production of electric power in space, as well as on Earth, at high rates of efficiency. Two types of the solar oven suitable for the system are discussed. Author

N81-27927# Committee on Science and Technology (U. S. House).

FUSION ENERGY: AN OVERVIEW OF THE MAGNETIC CONFINEMENT APPROACH, ITS OBJECTIVES, AND PACE

Washington GPO 1980 193 p refs Rept. presented to the Subcomm. on Energy Res. and Production of the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., Dec. 1980 Prepared by Congressional Research Service, Library of Congress
(GPO-68-856) Avail: SOD HC

All facets of the United States fusion program are discussed. The magnetic confinement research and development program is briefly described and the scientific achievements to data are discussed. Emphasis is also given to defining the steps necessary to accelerate the pace of the magnetic fusion program in the Department of Energy. R.C.T.

N81-27928# JAYCOR, Alexandria, Va.

DEVELOPMENT AND EXPLORATION OF THE CORE-CORONA MODEL OF IMPLODING PLASMA LOADS Final Report, 5 Feb. 1979 - 5 Mar. 1980

John Guillory and Robert Terry Jul. 1980 122 p refs
(Contract DNA001-79-C-0180; JAYCOR Proj. 6140)
(AD-A099718; JAYCOR-TPD-200-80-001-DFR) Avail: NTIS HC A06/MF A01 CSCL 20/9

This program has as its primary objective the quantitative exploration and generalization of the core-corona model of imploding plasma load dynamics in close collaboration with radiation physics and modeling work. As a qualitative summary, one may say that the core-corona model arises from four physical considerations, all interrelated. The first assumption is that of a sharp density falloff in the outer regions of the annular plasma load. The transition region between the dense core plasma and the halo of corona plasma surrounding it is associated with a change from classical to anomalous resistivity, due to the onset of marginally stable microturbulence in the low density corona plasma. The second assumption is that the high-density annular wire/plasma core stops a penetrating coronal electron in distances short compared to the core dimensions, so that the coronal heating can couple to the core and soften the implosion. However, it is important to note that coronal electrons will not tend to execute straight orbits into the core, due to the large magnetic fields in the current carrying zone on the core surface. A third ingredient in the core/corona equation is an isothermal corona, and for this one must assume the corona to be sufficiently limited in space that equilibration to an isothermal pressure balance can be established rapidly as the core annulus implodes. The corona continuously re-established its pressure balance as the transition interface moves inward. The final constraint in the original core-corona model equations was that of quasi-static heat balance between ohmic heating in the corona, net deposition of hot electron energy into the core, and coronal radiative losses. GRA

N81-27929# JAYCOR, Alexandria, Va.

ELECTRON HEATING IN STRONGLY BEADED HIGH-Z PINCH DISCHARGES AT HIGH DENSITIES

J. Guillory May 1981 24 p refs
(Contract DNA001-79-C-0189)
(AD-A099719; JAYCOR-J207-81-003) Avail: NTIS HC A02/MF A01 CSCL 20/9

The late-time, fully-developed stage of sausage-like 'beading' of z-pinch discharges can give rise to enhanced electron heating (and thus enhanced radiative losses), caused by Ohmic anomalous heating in the constricted regions. In this report, this transfer of energy from condensations of magnetic field energy to radiation is examined quantitatively, based on a simplified dynamical model for the nonlinear instability driving terms. Constricted portions of the discharge, with low density and cross section, and mostly or entirely anomalous current, alternate with the higher density beads, which carry current classically. The extreme limit of this phenomenon is that of multiple diodes in series, with the nearly-evacuated low density regions considered as bipolar-flow diodes, with pinched electron flow. In all probability, the low-density regions cannot evacuate to the extent required for such vacuum-diode behavior. The overall resistive heating rate is of course VI, with the total current I given by appropriate circuit equations, but the local heating rates for electrons in the low density regions are balanced by increased radiative loss when these hotter electrons collide with the denser blobs of plasma. The blobs cannot respond hydrodynamically to the increased heating before radiation loses the deposited energy. GRA

N81-27930# JAYCOR, Alexandria, Va.

MODELING OF IMPLODED ANNULAR PLASMAS Annual Report

Robert E. Terry and John U. Guillory May 1981 79 p refs
(Contract DNA001-79-C-0189)
(AD-A099720; JAYCOR-J207-81-004) Avail: NTIS HC A05/MF A01 CSCL 20/9

This report treats three areas of advance during the 1980 effort: (1) improvements to the 1-D strongly-coupled plasma implosion and radiation code SPLAT and results of radiative yield studies using the code; (2) development of formalism for solving the field penetration/skin-depth problem in an in-

homogeneous, time-varying imploding conductor in a plasma-loaded diode; (3) circuit equation and scaling of hard radiation in the presence of fully developed sausage instability (beading) of the assembled plasma. In addition, a short section (Chapter 5) is devoted to work in progress: high-accuracy matrix inversion techniques and interpolators for solving the generalized Hertz vector equations used in 2 above, and for following CRE equations and diffusive behavior in general; and, beginning plans for modifying 1-D MHD codes, making them compatible with the field-diffusion and corona programs and with CRE radiation packages. GRA

N81-27931# Maryland Univ., College Park. Lab. of Plasma and Fusion Energy Studies.
RADIATION FROM A RELATIVISTIC ELECTROM BEAM IN A MOLECULAR MEDIUM DUE TO PARAMETRIC PUMPING BY A STRONG ELECTROMAGNETIC WAVE
H. Wilhelmsson (Chalmers Univ. of Technology, Goeteborg, Sweden) and I. Stenflo (Umea Univ., Sweden) Feb. 1981 7 p refs
(Contract N00014-77-C-0590)
(AD-A099913; PL-81-024; PUB-81-160) Avail: NTIS HC A02/MF A01 CSCL 20/9

Parametric interaction of longitudinal and transverse waves is studied for a system consisting of a relativistic electron beam interpenetrating a molecular medium. The analysis suggests new possibilities for free-electron generation of coherent radiation. Author (GRA)

N81-27932# Army Military Personnel Center, Alexandria, Va.
INVESTIGATION OF TOKAMAK SOLID DIVERTOR TARGET OPTIONS M.S. Thesis - MIT. Final Report
John M. McMurray 26 May 1981 127 p refs
(AD-A099692) Avail: NTIS HC A07/MF A01 CSCL 18/5

Analysis of survival constraints on the design of solid targets for Tokamak bundle divertors is presented. Previous target design efforts are reviewed. Considerations of heat removal, surface erosion, and fatigue life are included in a generalized design window methodology which facilitates target selection. Using subcooled water as coolant, eight possible target materials are evaluated for use in tubular and plate targets as substrates, coatings, and claddings. Subject to the severe environment of the Tokamak plasma, the most promising conventional designs are identified. A thermally bonded, mechanically unbonded laminated design is proposed and evaluated as a target design well suited to the divertor target environment. Due to fatigue and sputtering erosion this configuration has limited life, but appears to constitute an upper bound for the capabilities of a solid target design. Needs for experimental work are identified. Author (GRA)

N81-27933# Sandia Labs., Albuquerque, N. Mex.
EFFECTS OF ANODE SPOT HEAT TRANSFER ON VACUUM ARC BEHAVIOR
D. A. Benson 1981 20 p refs Presented at Process Technol. Review Meeting, Albuquerque, N. Mex., 12 Feb. 1981
(Contract DE-AC04-76DP-00789)
(SAND-81-0362C; CONF-810224-1) Avail: NTIS HC A02/MF A01

Vaporization of anode material by a plasma in a vacuum arc as a source of ions for neutron tube applications is discussed. A model which balances heat input from the plasma against losses due to vaporization, radiation, and conduction within the anode material is used. The anode spot heating by the plasma is described by a simple power feedback model. These calculations are then compared to previous surface temperature measurements on anode spots in an ion source. Examples of parametric analyses showing the effect of material property variations of the arc behavior are described. DOE

N81-27934# Massachusetts Inst. of Tech., Cambridge.
THERMAL ENERGY DIFFUSION IN PLASMAS WITH WEAK OHMIC HEATING
B. Coppi Oct. 1980 6 p refs Presented at the 2nd Grenoble-Varenna Intern. Symp. on Heating of Toroidal Plasmas, Como, Italy, 1980 Submitted for publication
(Contract DE-AS02-78ET-53073)
(CONF-800932-8; PRR-80/23) Avail: NTIS HC A02/MF A01

The diffusion coefficient for the electron thermal energy was found to reproduce well a relatively large variety of experiments in which most of the electron heating is ohmic. An analysis of the diffusion is given. DOE

N81-27935# Pennsylvania State Univ., University Park.
COMPUTER MODELING OF THETA-PINCH BEHAVIOR WITH PLASMA-COLUMN ROTATION
J. R. McCowan, Edward H. Klevans, Thomas M. York, and John E. Heidrich Jan. 1981 16 p refs
(Contract DE-AS02-76ET-53018)
(DOE/ET-53018/5; SR-81-4) Avail: NTIS HC A02/MF A01

Radial pressure contributed by plasma column rotation is included in a zero dimensional, time dependent computer model used to describe post implosion behavior of a linear theta pinch device modeled with a diffuse density profile. When the parameter alpha = m sub i a (2) omega (2)/2T less than 1, where m sub i is the ion mass, omega is the rotation frequency, a is the plasma radius, and T = T sub i + ZT sub e is the plasma temperature, rotational pressure results in a suppression of the internal magnetic field. This leads to an increase in the rate of flux diffusion and ohmic heating. The predictions of the computer simulations agree favorably with results of one experiment characterized by alpha = 1.08 and indicate that rotation is important in accounting for observed electron temperature behavior. DOE

N81-27936# Illinois Univ., Urbana.
IDEAL MHD STABLE START-UP
R. A. Nebel, R. W. Moses, and G. H. Miley 1980 5 p refs Presented at the Reversed Field Pinch Theory Workshop, Los Alamos, N. Mex., 28 Apr. 1980
(Contract DE-AS02-76ET-52040)
(COO-2218-198; CONF-800484-9) Avail: NTIS HC A02/MF A01

A start-up scenario which theoretically predicts ideal magnetohydrodynamic (MHD) stability for both local and global modes during the start-up and burn phases for a reverse field pinch (RFP) reactor was found. Toroidal current density must be peaked off-axis in the prereversed phase in order to maintain stability. Density and pressure are peaked off-axis in order to stabilize Suydam modes in the weakly sheared plasma interior during the burn phase. DOE

N81-27937# Argonne National Lab., Ill.
PLASMA SHEATH REGION NEAR A BOUNDARY WITH POSITIVE ION BACKSCATTERING
J. N. Brooks Apr. 1981 22 p refs
(Contract W-31-109-eng-38)
(ANL/FPP/TM-142) Avail: NTIS HC A02/MF A01

The sheath region at a boundary perpendicular to a magnetic field was studied by numerically solving time independent Vlasov-Poisson equations for a DT plasma. Boundary conditions are specified for particles entering the sheath region and for particles returning from the boundary. The effect of hydrogen ion backscatter as well as electron reemission was examined. For a space charge limited electron reemission condition, even a small amount of ion backscatter changes the sheath parameters substantially, lowering the sheath potential and increasing the heat transmission. DOE

N81-27938# General Atomic Co., San Diego, Calif.
MBC: A BALLOONING STABILITY CODE FOR FINITE TOROIDAL MODE NUMBER
R. Moore Mar. 1981 26 p refs
(Contract DE-AT03-76ET-51011)
(GA-A-16243) Avail: NTIS HC A03/MF A01

The ballooning mode stability code MBC calculates the stability of numerically-generated Tokamak equilibria to ideal magnetohydrodynamic pressure-driven modes for finite toroidal mode number. A summary of the input and output used by MBC is given. DOE

N81-27939# Argonne National Lab., Ill.
TOKAMAK REACTOR STUDIES
C. C. Baker Jan. 1981 71 p refs
(Contract W-31-109-eng-38)

(ANL/FPP/TM-143) Avail: NTIS HC A04/MF A01

An overview of Tokamak reactor studies is presented with particular attention to commercial reactor concepts developed within the last three years. Emphasis is placed on DT fueled reactors for electricity production. A brief history of tokamak reactor studies is presented. The STARFIRE, NUWMAK, and HFCTR studies are highlighted. Recent developments that increased the commercial attractiveness of Tokamak reactor designs are discussed. These developments include smaller plant sizes, higher first wall loadings, improved maintenance concepts, steady state operation, nondivertor particle control, and improved reactor safety features. DOE

N81-27940# California Univ., Livermore. Lawrence Livermore Lab.

RAILGUNS AND PLASMA ACCELERATORS: ARC ARMATURES, PULSE POWER SOURCES AND US PATENTS

O. M. Friedrich, Jr. Nov. 1980 48 p refs

(Contract W-7405-eng-48)

(UCID-18830-Rev-1) Avail: NTIS HC A03/MF A01

A review of railguns and plasma accelerators is presented. Railguns and plasma accelerators are used to create high pressures for equation of state studies and in impact fusion. Railgun performance is critically dependent on armature operation. Plasma arc railgun armatures are addressed and pulsed power supplies for multistage railguns are considered. The compensated pulsed alternator, or compulsator, rotating machinery, and distributed energy sources for railguns are discussed. A review of the US patents on multistaging techniques for electromagnetic accelerators, plasma propulsion devices, and electric guns is appended. DOE

N81-27941# Oak Ridge National Lab., Tenn.

NEOCLASSICAL TRANSPORT OF IMPURITIES IN TOKAMAK PLASMAS

S. P. Hirshman and D. J. Sigmar May 1981 239 p refs

(Contract W-7405-eng-26)

(ORNL/TM-7588) Avail: NTIS HC A11/MF A01

The determination of the complete neoclassical Onsager matrix for a toroidally confined multispecies plasma, which provides the linear relation between the surface averaged radial fluxes and the thermodynamic forces (i.e., gradients of density and temperature, and the parallel electric field), is reviewed. A closed set of one dimensional moment equations is presented for the time evolution of thermodynamic and magnetic field quantities which results from collisional transport of the plasma and two dimensional motion of the magnetic flux surface geometry. The effects of neutral beam injection on the equilibrium and transport properties of a toroidal plasma are consistently included. DOE

N81-27942# Texas Univ., Austin. Inst. for Fusion Studies.

ENERGY PRINCIPLE WITH GLOBAL INVARIANTS

A. Bhattacharjee and R. L. Dewar Apr. 1981 61 p Prepared in cooperation with Princeton Univ., N.J.

(Contracts DE-FG05-80ET-53088; DE-AM02-76CH-03073)

(DOE/ET-53088/19) Avail: NTIS HC A04/MF A01

A variational principle is proposed for constructing equilibrium with minimum energy in a toroidal plasma. The total energy is minimized subject to global invariants which act as constraints during relaxation of the plasma. These global integrals of motion are preserved exactly for all ideal motions and approximately for a wide class of resistive motions. We assume, specifically, that relaxation of the plasma in dominated by a tearing mode of single helicity. Equilibria with realistic current density and pressure profiles may be constructed in this theory, which is also used here to study current penetration in Tokamaks. The second variation of the free energy functional is computed. It is shown that if the second variation of any equilibrium constructed in this theory is positive, the equilibrium satisfies the necessary and sufficient conditions for ideal stability. DOE

N81-27943# Texas Univ., Austin. Inst. for Fusion Studies.

RENORMALIZATION OF PLASMA TURBULENCE IN TOROIDAL GEOMETRY

R. D. Hazeltine Apr. 1981 14 p refs

(Contract DE-FG05-80ET-53088)

(DOE/ET-53088/18) Avail: NTIS HC A02/MF A01

A renormalized kinetic equation is derived for electromagnetic turbulence in an axisymmetric torus, which is formally very similar to the electrostatic, cylindrical version which it generalizes. DOE

N81-27944# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.

ON THE KINK STABILITY OF A LINEAR EXTRAP PINCH Research and Training Programme on Controlled Thermonuclear Fusion and Plasma Research (EUR-NE)

B. Lehnert Nov. 1980 30 p refs

(TRITA-PFU-80-10; ISSN-0348-7644) Avail: NTIS HC A03/MF A01

The relevant stabilizing and destabilizing mechanisms in a linear Z-pinch of 'Extrap' type are elucidated. The particular case of plane incompressible kink modes is analyzed. In this pinch there is a superimposed transverse inhomogeneous magnetic field B sub v, produced by currents in a set of external conductor rods. A modified form of the energy principle which takes explicit account of induced surface current is introduced. The stabilizing mechanisms are found to be due to induced surface currents in the transverse field B sub v, to induced volume currents in B sub v, and to volume currents induced by inhomogeneous motion in the field B sub p generated by the current. Furthermore, a cross-effect between B sub v and B sub p leads to destabilizing or stabilizing contributions depending on the orientation of the kink. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N81-27945 British Library Lending Div., Boston Spa (England).

A METHOD FOR INVESTIGATING THE TEMPERATURE ZONE IN CRYSTALS BEING GROWN FROM THE MELT

A. I. Somov, M. A. Tikhonovskii, and V. V. Reznichenko Feb. 1981 7 p refs Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (USSR), Jan. - Feb. 1979 p 103-131

(BLL-RTS-12305) Avail: British Library Lending Div., Boston Spa, England

A method for studying the effect of various technical parameters on the temperature zone of a crystal is based on the use of the type of eutectic alloys in which one of the phases undergoes eutectoidal decomposition. By making a series of successive longitudinal microsections of a crystal drawn sharply out of the melt, the complete isothermal concersion surface can be constructed. The eutectic melt Co/23 atom % Si was used as the model to illustrate the application of the method for investigating the dependence of the axial temperature gradient near the crystallization front on the diameter of the crystal. A.R.H.

N81-27946 British Library Lending Div., Boston Spa (England).

THE CALCULATION OF THE COMPRESSIBILITY OF REGULAR CRYSTALS FROM THE LATTICE THEORY

M. Born and A. Lande Jan. 1981 10 p refs Transl. into ENGLISH from Deut. Physik. Ges. (Germany), v. 20, no. 21-24, 1918 p 210-216

(BLL-RTS-12055) Avail: British Library Lending Div., Boston Spa, England

The calculation of crystal properties from the early formulations of atomic structure is discussed. Specifically, it is shown that calculations of compressibility refute the notion of the two dimensional electron shell system and point to a model in which the electrons are uniformly distributed in the directions of space. M.G.

N81-27947 British Library Lending Div., Boston Spa (England). Article Translating Service.

ACICULAR NaCl CRYSTALS GROWN FROM THE VAPOUR PHASE

T. Gyorgy, Gyoergy Turchanyi, Tunde Horvath, and Imre Tarjan Jan. 1981 18 p refs Transl. into ENGLISH from Magy. Fiz. Foly. (Hungary), v. 11, no. 3, 1963 p 197-204

(BLL-RTS-11903) Avail: British Libary Lending Div., Boston

Spa, England

Simple observation of acicular crystalline forms is used to show that these forms' shapes may be explained by dislocation mechanism. The shapes described include: (1) skeletal acicular crystals terminating in a frustrum; (2) acicular crystals, grown in the (110) direction, showing the (100) staircases; and (3) systematic changes in taking place in acicular crystals during thermal treatment such as crystals built up from blocks that slide away and zig-zag acicular crysals. A.R.H.

N81-27948*# Maryland Univ., College Park. Dept. of Physics and Astronomy.

SOLID STATE CRYSTAL PHYSICS AT VERY LOW TEMPERATURES Final Report, 1 Jul. 1979 - 30 Jun. 1980

W. Davis, K. Krack, J.-P. Richard, and J. Weber 30 Jun. 1980 64 p refs

(Grant NsG-7196)

(NASA-CR-164548) Avail: NTIS HC A04/MF A01 CSCL 20L

The mechanical dissipation (Q) and resonant frequency of a 15 kg silicon crystal were measured at cryogenic temperatures. In the experiment described, temperature control was incorporated to reduce the time derivative of the temperature. The results of the Q measurements with and without this temperature control are quite different. Measurements of the resonant frequency of the fundamental longitudinal mode of the silicon crystal from 6 to 300 Kelvin are presented and discussed with respect to temperature, df/dT. It is observed that frequency increases as temperature decreases down to about 16 Kelvin, i.e. dt/dT is negative. However, below this temperature the frequency decreases as temperature decreases, i.e. dt/dT is positive. It is suggested that this behavior is related to the coefficient of thermal contraction of silicon, which changes sign at 18 Kelvin. Continuation of these experiments to 20 mK is discussed. J.M.S.

N81-27949*# College of William and Mary, Williamsburg, Va.

SILICON SUPERLATTICES: THEORY AND APPLICATION TO SEMICONDUCTOR DEVICES Final Report, Jan. 1980 - Jul. 1981

J. A. Moriarty Jul. 1981 33 p refs

(Grant NAG1-33)

(NASA-CR-164568) Avail: NTIS HC A02/MF A01 CSCL 20L

Silicon superlattices and their applicability to improved semiconductor devices were studied. The device application potential of the atomic like dimension of III-V semiconductor superlattices fabricated in the form of ultrathin periodically layered heterostructures was examined. Whether this leads to quantum size effects and creates the possibility to alter familiar transport and optical properties over broad physical ranges was studied. Applications to improved semiconductor lasers and electrondevices were achieved. Possible application of silicon sperlattices to faster high speed computing devices was examined. It was found that the silicon lattices show features of smaler fundamental energyband gaps and reduced effective masses. The effects correlate strongly with both the chemical and geometrical nature of the superlattice. E.A.K.

N81-27950*# Cornell Univ., Ithaca, N. Y. Lab. of Atomic and Solid State Physics.

ORDERED GROUND STATES OF METALLIC HYDROGEN AND DEUTERIUM

N W. Ashcroft Jul. 1981 6 p refs

(Grant NsG-7487)

(NASA-CR-164621; MSC-4523) Avail: NTIS HC A02/MF A01 CSCL 20L

The physical attributes of some of the more physically distinct ordered states of metallic hydrogen and metallic deuterium at T = 0 and nearby are discussed. The likelihood of superconductivity in both is considered with respect to the usual coupling via the density fluctuations of the ions. R.C.T.

N81-27951*# Arizona Univ., Tucson.

HIGH SENSITIVITY OPERATION OF DISCRETE SOLID STATE DETECTORS AT 4 K Final Report

G. H. Rieke, E. F. Montgomery, M. J. Lebofsky, and P. R. Eisenhardt [1981] 16 p refs

(Contract NAS2-10227; Grants NSF AST-76-81874; NSF AST-78-22482)

(NASA-CR-166217) Avail: NTIS HC A02/MF A01 CSCL 20L

Techniques are described to allow operation of discrete, solid state detectors at 4 K with optimized JFET amplifiers. Three detector types cover the 0.6 to 4 mm spectral range with NEP approximately equal to 10 to the 16th power Hz (-1/2) for two of the types and potential improvement to this performance for the third. Lower NEP's are anticipated at longer infrared wavelengths. R.C.T.

N81-27952# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.

PROXIMITY EFFECTS IN ELECTRON BEAM LITHOGRAPHY

G. J. Iafrate, C. F. Cook, Jr., and J. Kwiatkowski Apr. 1981 18 p refs

(DA Proj. 1L1-61102-AH-47)

(AD-A099828; DELET-TR-81-11) Avail: NTIS HC A02/MF A01 CSCL 20/12

The required miniaturization of military IC devices to submicron and ultra-submicron dimensions in the 1980s raises serious questions regarding the use of electron beam (e-beam) lithography an appropriate fabrication technique for this end. In this paper it is shown that the ultimate resolution of the e-beam process is determined by electron scattering effects in the lithographic resist material and by electron back-scattering from the underlying device substrate. The merit of the e-beam fabrication technique for use in very high speed integrated circuit (VHSIC) technology is assessed. A study is presented which describes the electron scattering and backscattering processes in electronic materials. A theoretical analysis describing primary electron backscattering from single- and double-layered substrates is presented; also, attention is focused on the question of the spatial region exposed by a scattered e-beam in a lithographic e-beam resist material. Experimental electron backscattering, e-beam, and scanning electron microscopy studies are used to corroborate theoretical findings. Author (GRA)

N81-27953# California Univ., Santa Barbara. Quantum Inst.

SHIFTS AND DIPS IN INELASTIC ELECTRON TUNNELING SPECTRA DUE TO THE TUNNEL JUNCTION ENVIRONMENT

A. Bayman, P. K. Hansma, and W. C. Kaska 27 May 1981 32 p refs Submitted for publication

(Contract N00014-78-C-0011; NR Proj. 056-673)

(AD-A099592; TR-9) Avail: NTIS HC A03/MF A01 CSCL 07/4

In general, the tunnel junction environment has proved to be surprisingly benign; tunneling spectra of molecules included within tunnel junctions are similar to infrared and Raman spectra of molecules not covered by a metal electrode. Peak shifts have been typically less than the line width of the peaks and peak intensities have been comparable to infrared and Raman intensities. This report provides a different situation for tunnel junctions containing molecules absorbed on metal particles. Specifically, we find that different top metal electrodes give different tunneling spectra for CO on alumina supported iron and rhodium particles. Though metals with similar atomic radii give similar spectra, metals with dissimilar atomic radii can give qualitatively different spectra. We also find anomalies concerning intensities. Specifically for methyl isocyanide adsorbed on alumina supported rhodium particles, the strongest peak in the infrared spectrum, the NC- stretching mode, appears as a dip in the tunneling spectrum. GRA

N81-27954# Hughes Research Labs., Malibu, Calif.

InP BY PLANAR REACTIVE DEPOSITION AND GaAs BY LOW PRESSURE METAL ORGANIC CHEMICAL VAPOR DEPOSITION Final Report, 1 Jun. 1976 - 30 Nov. 1980

K. Zanio Feb. 1981 145 p refs

(Contract F44620-76-C-0133; AF Proj. 2306)

(AD-A099993; AFOSR-81-0474TR) Avail: NTIS HC A07/MF A01 CSCL 20/12

The planar reactive deposition (PRD) technique was developed to grow InP thin films by vacuum evaporation in a H2 reactive atmosphere. InP films with room temperature mobilities as high as 4062 sq cm/Vsec and carrier concentrations (N sub D -N

sub A) as low as 10 to the 16th power cu/cm were grown on (100) semi-insulating substrates. N+ films with carrier concentration of a few times 10 to the 19th power cu/cm were obtained using Sn doping. N+/N/N+ multilayer structures, and large area (10 cm) epitaxial films were grown on InP substrates. Epitaxial films of InGaAs, InGaP and InGaAsP were grown by PRD, and lattice matched to InP and GaAs substrates. As an intermediate step to grow InP by low pressure metal organic chemical vapor deposition (LPMOCVD), GaAs was grown by LPMOCVD. Unintentionally doped p-type GaAs, with hole concentration as high as a few times 10 to the 20th power cu/cm, was grown at the Ga-rich three-phase boundary. By undertaking growth away from the boundary, the hole concentration decreased, and ionized impurity concentrations (N sub A + N sub D) as low as 10 to the 16th power cu/cm were obtained. Major background impurities for growth of InP by PRD and GaAs by LPMOCVD are carbon and oxygen. Growth of InP in a halide environment is recommended to obtain higher purity InP thin films by low cost vacuum technologies. Author (GRA)

N81-27955# Tennessee Univ., Knoxville. Ultrasonics Lab.
ULTRASONIC DETERMINATION OF COMBINATIONS OF THIRD-ORDER ELASTIC CONSTANTS OF SMALL CUBIC SINGLE CRYSTALS Interim Technical Report
Bruce Dion Blackburn May 1981 107 p refs
(Contracts N00014-76-C-0177; N00014-71-A-0121)
(AD-A100038; TR-20) Avail: NTIS HC A06/MF A01 CSCL 20/1

The ultrasonic harmonic generation technique for measuring combinations of third-order elastic constants of cubic single crystals previously has been limited by the plane wave approximation to measurement of samples whose cross sectional dimensions are greater than or equal to 1.5 cm. By obtaining data with small transducers and considering the effects of diffraction, the range of samples measurable with the technique has been extended to samples of approx. equal to 5 mm on a side. This development has made possible measurement of single crystals unavailable in large dimensions. The minimum length required for measurement depends on the materials and on the cross sectional dimensions; the current estimate of the minimum length is approx. equal to 4 mm. Diffraction corrections based on the Kirchhoff diffraction theory are presented and analyzed for both the fundamental frequency component and the second harmonic component of the ultrasonic wave. The technique was used to measure combinations of third-order elastic constants of small samples of CsCdf3 and KZnF3. The measured combinations obtained by correcting only the fundamental frequency component for diffraction, are provided. GRA

N81-27956# Perkin-Elmer Corp., Norwalk, Conn.
GROWTH OF ALUMINUM GALLIUM NITRIDE THIN FILMS FOR ELECTRO-OPTIC DEVICE APPLICATIONS Final Report, 6 Sep. 1977 - 15 Feb. 1981
Donald L. Smith and Richard H. Bruce 15 Feb. 1981 43 p refs
(Contract N00014-77-C-0492)
(AD-A099517; PE-28935) Avail: NTIS HC A03/MF A01 CSCL 20/12

Highly p-doped (AlGa)N offers the prospect of very efficient and sharp-cutoff solar-blind photocathodes, as well as near-UV solid-state lasers. However, AlN reported to date has been semi-insulating, and GaN has been semi-insulating or n-type. Spontaneous generation of compensating N-vacancy donors is believed responsible for the inability to p-dope GaN. In this work, GaN was deposited on sapphire by reaction of Ga with a high-pressure (100 Pa) N2 plasma over the substrate. High plasma pressure and low substrate temperature were used in order to inhibit N-vacancy formation. Be, a likely and low-volatility p-dopant, was co-deposited. After it proved impractical to introduce Ga into the N2 plasma by evaporation, it was sputtered in a 100 Pa DC N2 plasma with much better success. Epitaxy of updoped films was obtained at 700 C, although films doped to 4 - 6 x 10 to the 20th power Be/cc were polycrystalline. All films turned out n-type by thermoelectric probing and exhibited a large activation energy for conduction, indicating the dominance of unintentional deep impurities. Undoped films had resistivities of 400,000 ohm-cm at 300 C and 20,000 ohm-cm at 600 C. Be doping increased conductivity by X100 and appeared to be acting as a deep donor. A cleaner sputtering environment and closer Be control are recommended in the further pursuit of p-type GaN. Author (GRA)

N81-27957# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
FABRICATION AND PROPERTIES OF MULTILAYER STRUCTURES Semiannual Technical Report, 1 Sep. 1980 - 28 Feb. 1981
W. A. Tiller, T. W. Barbee, Jr., L. Nagel, K. Seaward, and W. Dibble Apr. 1981 64 p refs
(Contract MDA903-79-C-0484; ARPA Order 3706)
(AD-A099793; SU-DMS-81-R-4; SATR-3) Avail: NTIS HC A04/MF A01 CSCL 13/8

The program has as its goal the development of vapor deposition processes for application to integrated circuit technology. Its purpose is to investigate vapor deposition techniques that offer potential for synthesis of materials having new, unique structures and/or of higher quality than currently attainable. Technological application of these materials will be a significant consideration in the selection of specific systems for study, particularly multilayer integrated circuit applications. In this period, experiments with the new cryopumped system were performed. Reactive sputtering research focused on a detailed study of SiOx and a more broad guage study of MOx films for a number of metals M (M = Si, W, Al, Zn, Zr, Mg) on 3-in. diameter wafers. High deposition rates, a wide range of stoichiometry and either amorphous or crystalline films were formed. The cleanliness of the new system is orders of magnitude better than the old system. Multiple source deposition studies focused on SiCx formation. X-ray analysis, refractive index and bandgap data all confirm the formation of SiC films. Good control of the sputter deposition of these films has been demonstrated. In the theoretical area, the constraints placed on closed n-ring assemblies (SinO3n) in SiO2 are being assessed to identify those constraints which differentiate the structure between the crystalline and vitreous forms. Author (GRA)

N81-27958# Sandia Labs., Albuquerque, N. Mex.
HIGH-TEMPERATURE MEASUREMENTS OF Q-FACTOR IN ROTATED X-CUT QUARTZ RESONATORS
I. J. Fritz 1981 3 p refs Presented at High Temp. Elec. Conf., Tucson, Ariz., 25 Mar. 1981
(Contract DE-AC04-76DP-00789)
(SAND-80-2659C; CONF-810316-3) Avail: NTIS HC A02/MF A01

The Q factors of piezoelectric resonators fabricated from natural and synthetic quartz with a 34 deg rotated X-cut orientation were measured at temperatures up to 325 C. the synthetic material, which was purified by electrolysis, retains a high enough Q to be suitable for high temperature pressure transducer applicationss whereas the natural quartz is excessively lossy above 200 C for this application. The results are compared to results obtained previously on AT cut resonators. DOE

N81-27959# Sandia Labs., Albuquerque, N. Mex.
PREPARATION OF IRON AND ALUMINUM SAMPLES FOR ION IMPLANTATION AND TEM EXAMINATION
J. M. McDonald Apr. 1981 14 p refs
(Contract DE-AC04-76DP-00789)
(SAND-81-0368) Avail: NTIS HC A02/MF A01

Transmission electron microscopy studies of ion implanted samples require one-sided thinning in order for the implanted surface to be examined. Techniques for thinning Fe and Al are described which are optimized to reproducibly obtain samples with maximum electron-transparent thin area. DOE

N81-27960# Oak Ridge National Lab., Tenn.
PROBLEM OF SHEAR CRACK WITH DISLOCATION-FREE ZONES
S. J. Chang May 1981 38 p refs
(Contract W-7405-eng-26)
(ORNL/CSD-75) Avail: NTIS HC A03/MF A01

Experimental observations by electron microscopy have shown a dislocation-free zone exists between the crack tip and a linear pile-up of dislocations in the plastic zone. A singular integral equation is formulated to describe the equilibrium configuration of the dislocations. The distribution function of the dislocations

and the stress intensity factor at the elastic crack tip are obtained in terms of elliptic integrals of the first and the third kinds. It is found that the stress intensity factor is approximately a function of the length of the dislocation-free zone whereas the externally applied stress approximately determines the length of the plastic zone. The results of the calculations indicate the interaction between the crack and the dislocations in the plastic zone and show the effect of stress relaxation within the dislocation-free zone due to the emission of the dislocations from the crack tip into the plastic zone. DOE

N81-27961# AEG-Telefunken, Ulm (West Germany). Forschungsinst.
PREPARATION OF Si DEVICES BY UHV EPITAXY Final Report
Erich Kasper, Horst Kibbel, Ulf Koenig, and Hans-Joest Herzog Bonn Bundesministerium fuer Forschung und Technologie Nov. 1980 77 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-102; BMFT-NT-0683; ISSN-0340-7608) Avail: NTIS HC A05/MF A01

Gas phase deposition of monocrystalline Si layers at temperatures below 1000 C was investigated. Both diffusion of dopant atoms and autodoping effects influence the dopant profile of thin epitaxial layers on highly doped substrates. In order to deposit thin epitaxial layers with abrupt junctions, high supersaturation and surface contamination, which often cause crystal defects, rough surfaces or even polycrystalline growth at low deposition temperatures must be suppressed. Thin n-doped epitaxial layers (0.1to 2.0 microns) with abrupt junctions were deposited on highly doped substrates by the UHV epitaxy method at a temperature of 750 C. Characterization of the layers, using various methods, show high crystalline quality and a smooth surface layer as well as high mobility of electrons. Microwave devices (Schottky mixer diodes) and integrated circuits (UHF and integrated injection logic circuits) were prepared from UHV epitaxial layers. Conversion efficiency and the high frequency limit of the devices are increased. Author (ESA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N81-27962# Commerce Dept., Washington, D.C.
THERMODYNAMICS OF HIGH TEMPERATURE MATERIALS Annual Report, 1 Oct. 1979 - 30 Sep. 1980
D. A. Ditmars, S. Abramowitz, A. Miller, A. Cezairliyan, and M. S. Morse Sep. 1980 40 p refs
(Contract AFOSR-ISSA-80-00007; AF Proj. 2306)
(AD-A098824; AFOSR-81-0443TR) Avail: NTIS HC A03/MF A01 CSCL 05/1

Heat capacity and electrical resistivity of a carbon--carbon composite has been measured in the range of 1500 to 3000 K. The melting point of palladium has been measured. Apparatuses for the measurement of thermal expansion and thermal diffusitivity are described. The enthalpy of pure silicon carbide has been measured in the range of 273 to 1200 K. A discussion of the experiments leading to the electronic ground state of FeO is provided. The vibrational spectrum of Boron trimethyl is provided with the thermodynamic implications. Author (GRA)

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

No abstracts in this category.

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N81-27963 British Library Lending Div., Boston Spa (England).
THE PRINTING
A. Kuhl and Orell Fuessli Feb. 1981 22 p refs Transl. into ENGLISH from Kriminalistik (Zurich), no. 5, 1979 p 216-222
(BLL-RTS-12320) Avail: British Library Lending Div., Boston Spa, Engl.

The entire spectrum of security technology which begins when the paper is ordered and concludes with the delivery to the customer of the Securities and documents is discussed. Included are constant contact with the customers and their specific security and consumer requirements, contact with the special police departments, the increasing fight against forgery and scope for forgery, and the essential conditions for the continuing improvement of existing operational and security techniques and for the development of new ones. S.F.

N81-27964 British Library Lending Div., Boston Spa (England).
EXONYMS: OBSTACLES TO INTERNATIONAL STANDARDISATION
F. J. Ormeling, Sr. Nov. 1980 19 p Transl. into ENGLISH of Kartografish Tisjdschrift, v. 6, no. 1, 1980 p 25-30
(BLL-RTS-12438) Avail: British Library Lending Div., Boston Spa, Engl.

The historical development of variant spellings of geographical names is discussed. The concept of exonyms is covered and arguments for and against international standardization of the way geographical names are written are presented. It is shown that exonyms are considered to be a hindrance to international standardization of geographical names. The role of the United Nations is examining this problem is addressed. J.M.S.

N81-27965 British Library Lending Div., Boston Spa (England).
ON-LINE ACCESS TO THE WORLD TRANSINDEX FILE
Denise Pelissier and Monorama Mallet Nov. 1980 24 p Transl. into ENGLISH of Rept. TRITA-LIB-4063 Royal Inst. of Technol. Library, Stockholm, Aug. 1979 p 1-27
(BLL-RTS-12416; TRITA-LIB-4063) Avail: British Library Lending Div., Boston Spa, Engl.

A data base is described which records translations of East European and Asian scientific and technical literature in Western languages. It is also capable of recording translations into French from other Western languages. The advantages of its on-line searching capability are also discussed with special emphasis on search strategy. R.C.T.

N81-27966# BioTechnology, Inc., Falls Church, Va.
TECHNICAL ORDER MANAGERS REFERENCE DATA Final Report, May 1978 - May 1980
G. Richard Hatterick and Harold E. Price Brooks AFB, Tex. Air Force Human Resources Lab. May 1981 297 p refs
(Contract F33615-78-C-0016; AF Proj. 1710)
(AD-A099779; AFHRL-TR-80-51) Avail: NTIS HC A13/MF A01 CSCL 05/1

In past years, research by Air Force and other DOD agencies has resulted in the development of several more effective techniques for developing and for presenting technical data for maintenance. Application of these development techniques and

improved presentation formats for operational use has been hindered by the fact that technical data managers frequently do not have sufficient information available on the improved techniques and formats to allow them to select and procure the improved data. The guidelines developed by this effort can be used by personnel who develop technical data for the Air Force and by those who manage such efforts. A thorough review of the state of the art in developing, presenting, and procuring technical data was accomplished to provide the basis for developing the guidelines. This was accomplished first by reviewing formats, specifications, and applicable literature and by then conducting extensive interviews with government and industry personnel who are knowledgeable of, and experienced in, current technical data procedures. The next phase involved analysis of these data, the selection of candidate formats, the development of descriptions on the formats, development of criteria for selecting formats and development of guidelines for procuring data. This report can be used as a basic reference publication by all individuals involved in Acquisition and Management of Air Force Technical Orders. The report provides the following information: developments in procedural data formats, job performance aid concepts and techniques, format test and evaluation, and format option selection data. GRA

N81-27967# BioTechnology, Inc., Falls Church, Va.
TECHNICAL ORDER MANAGEMENT AND ACQUISITION Final Report
G. Richard Hatterick and Harold E. Price Brooks AFB, Tex. Air Force Human Resources Lab. May 1981 410 p refs
(Contract F33615-78-C-0016; AF Proj. 1710)
(AD-A099705; AFHRL-TR-80-50) Avail: NTIS HC A18/MF A01 CSCL 05/1

In past years, research by Air Force and other DOD agencies has resulted in the development of several more effective techniques for developing and for presenting technical data for maintenance. Application of these development techniques and improved presentation formats for operational use has been hindered by the fact that technical data managers frequently do not have sufficient information available on the improved techniques and formats to allow them to select and procure the improved data. The guidelines developed by this effort can be used by personnel who develop technical data for the Air Force and by those who manage such efforts. A thorough review of the state of the art in developing, presenting and procuring technical data was accomplished to provide the basis for developing the guidelines. This was accomplished first by reviewing available formats, specifications, and applicable literature and by then conducting extensive interviews with government and industry personnel who are knowledgeable of, and experienced in, current technical data procedures. The next phase involved analysis of these data, the selection of candidate formats, the development of descriptions on the formats, development of criteria for selecting formats and development of guidelines for procuring data. This report provides specific information and guidance for the acquisition and management of Air Force technical orders (T.O.s). The report provides the following information: an overview explaining the guidebook scope, organization, and contents accompanied with an explanation of how to use the guidebook. GRA

N81-27968# Naval Ship Research and Development Center, Bethesda, Md.
NAVY LIBRARIES' INFORMATION STORAGE AND RETRIEVAL SYSTEM. PROCEEDINGS OF THE (38TH) CONSATL WORKSHOP AND MEETING
Apr. 1981 104 p refs Conf. held 23-25 Apr. 1980
(AD-A099716) Avail: NTIS HC A06/MF A01 CSCL 05/2

Contents: User Needs for Library Automation; Overview of the Automated Library System; Outline for a Comprehensive Information Systems Analysis; Basis Battelle's Data Management System; Database Input, Circulation System, Reports System Byproduct; and Information Retrieval Features. GRA

N81-27969# Recheninstitut fuer das Bauwesen, Stuttgart (West Germany).
USE OF COMPUTERS FOR THE DOCUMENTATION OF SUPPY LINES Final Report
Walter Leibbrand, Thomas Koehler, and Georg Heidinge Bonn Bundesministerium fuer Forschung und Technologie Aug. 1980 424 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie Prepared in cooperation with IKO Software Service GmbH
(BMFT-FB-DV-80-007; ISSN-0170-9011;
BMFT-0815073/DV0792) Avail: NTIS HC A18/MF A01

The application of computer systems for the management of gas, water and/or electricity distribution is studied. Examples of existing uses, such as the implementation of computer graphics to compile and update utility users maps, are cited. The establishment of data bases for the administration of network data is explained. Qualified statements are made on the criteria that must be taken into account by a utility company when introducing computers into their operation. Hardware and software problems are emphasized along with organizational aspects.
Author (ESA)

N81-27970# Beratung fuer Computerisierte Informations- und Dokumentationssystem, Munich (West Germany).
NOTATION FOR INDEXING LANGUAGES AND CLASSIFICATIONS Final Report
Horst G. Koerner Bonn Bundesministerium fuer Forschung und Technologie Sep. 1980 134 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-ID-80-013; ISSN-0170-8996;
BMFT-IDA0120-1022001) Avail: NTIS HC A07/MF A01

An overview is given of the basic types of notation that can be designed. Included are the sequential (or purely ordinal) notations with hierarchical level indicator. It is shown that left aligned sequential notations are very flexible, i.e., it is easy to handle insertions and other changes. The evaluation of notations, carried out with an example, is done with a quite comprehensive catalog of desiderata. For design decisions the methods of worth analysis are recommeded, especially when considering whether or not to employ notation at all. Another possibility is to use notational symbols only for certain hierarchical levels. Author (ESA)

N81-27971# National Bureau of Standards, Washington, D.C. National Measurement Lab.
TECHNICAL ACTIVITIES 1980, OFFICE OF STANDARD REFERENCE DATA
S. P. Fivozinsky Dec. 1980 57 p
(PB81-164527; NBSIR-81-2206) Avail: NTIS HC A04/MF A01 CSCL 07D

The activities of the Office of Standard Reference Data, one of six program offices in the National Measurement Laboratory National Bureau of Standards, are summarized. The Standard Reference Data Program develops and disseminates data bases of critically evaluated physical/chemical properties of substances. The Office of Standard Reference Data is responsible for management and coordination of the program. Work is carried out through a decentralized network of data centers and projects referred to as the National Standard Reference Data System. GRA

N81-27972# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
MANUAL OF DOCUMENTATION PRACTICES APPLICABLE TO DEFENCE-AEROSPACE SCIENTIFIC AND TECHNICAL INFORMATION, VOLUME 4
S. C. Schuler, ed. Mar. 1981 124 p refs
(AGARD-AG-235-Vol-4; ISBN-92-835-1382-7) Avail: NTIS HC A06/MF A01

Several aspects of technical information services are considered. Security requirements, the management of documentation centers, and national and interntional information networks are discussed. For individual titles, see N81-27973 through N81-27975.

N81-27973# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
STORAGE AND SECURITY CONTROL, SECTION 10
Michael G. Sims (Sims, (Michael G.), England) *In its* Manual of Doc. Pract. Appl. to Defence-Aerospace Sci. and Tech. Inform., Vol. 4 Mar. 1981 p 5-31 refs (For primary document see N81-27972 18-82)

Avail: NTIS HC A06/MF A01

The organization and administration of the security arrangements in a documentation center are described. The problems raised by the need for physical and personnel security are discussed. Document security requirements are considered from publication stage, through to issuing, dissemination, release, filing, storage, handling, circulation control, downgrading, and final disposal. The security grading of document is described. Access to sensitive documents by onsite users and external borrowers is considered. The differing requirements for security of items in various formats are discussed. The protection required in peripheral areas such as reprographic and computer rooms is considered. J.D.H.

N81-27974# Manchester Univ. (England).
ORGANIZATION AND MANAGEMENT, SECTION 11
Diana M. Leich *In* AGARD Manual of Doc. Pract. Appl. to Defence-Aerospace Sci. and Tech. Inform., Vol. 4 Mar. 1981 p 33-92 refs (For primary document see N81-27972 18-82)
Avail: NTIS HC A06/MF A01

The establishment of a technical information center and its aims and objectives are discussed. The identification and fulfillment of user requirements are shown to be vital to its success and the way in which these can be achieved by good management is emphasized. Careful planning is essential at all stages and many aspects of planning are escribed. The role of the staff, in particular that of the information manager, is defined and the effectiveness of the information center is shown to be highly dependent on their contribution to it. Budget management and stock control are discussed and the impact of mechanization is considered. Active promotion of the services of the center is necessary and ways of achieving this are outlined. Author

N81-27975*# NASA Scientific and Technical Information Facility, Baltimore/Washington International Airport, Md. 21240.
NETWORKS AND EXTERNAL SOURCES OF INFORMATION, SECTION 12
Philip F. Eckert, Hal G. Wynne, W. A. Martin (ESA, Rome), and Angelo Bodini (ESA, Rome) *In* AGARD Manual of Doc. Pract. Appl. Defence-Aerospace Sci. and Tech. Inform., Vol. 4 Mar. 1981 p 93-110 refs Sponsored by NASA (For primary document see N81-27972 18-82)
Avail: NTIS HC A06/MF A01 CSCL 05B

The basic functional aspects of telecommunications, text searching, and networking are reviewed. Some of the information services, both commercial and noncommercial, which are operational in the United States and Europe are described. The ARPANET, TELENET, TYMET, and EURONET packet networks are described. External online bibliographic data bases and factual data banks are reviewed. Details of services offered, specific topics available, and contact points are given for: (in the United States) the NASA/RECON, DOE/RECON, Defense RDT and E, Lockheed Information System (DIALOG), SDC ORBIT, and the bibliographic Retrieval systems; and (in Europe), ESA/IRS, the International Atomic Energy Agency, TELESYSTEMS, SPIDEL, INKA DIMDI DATA-STAR, BLAISE, and PERGAMON-INFOLINE systems. J.D.H.

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N81-27976*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGHLIGHTS OF NASA/DOE PHOTOVOLTAIC MARKET ASSESSMENT VISIT TO MOROCCO
9 Jun. 1981 11 p refs
(NASA-TM-82288) Avail: NTIS HC A02/MF A01 CSCL 05C

A broad range of agricultural, rural development, and other power applications in various regions of Morocco were examined to determine the potential market for photovoltaic products in Moroccan development. The primary focus of the study was the agriculture sector which accounts for approximately 17% of the country's GNP. The country has a clear need for reliable remote power systems, but does not have the financial resources to invest in the relatively high capital cost PV equipment. A modest potential for PV use was identified in nonagricultural rural services, such as refrigerators for rural clinics and rural radio-telephones. The main potential for PV in Morocco in the next five years lies mainly in the telecommunications sector. Applications include rural TV sets, TV repeater stations, microwave relay stations, and railroad, marine, and airline signalling. Market size estimates were derived from development and expansion plans. At an average customer cost for complete installed systems from $18/Wp to $30/Wp the total potential market value is estimated in the range of $6.6 to $11 million over the 1981-1986 period. A.R.H.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N81-27977# Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1982, PART 1
Washington GPO 1981 316 p Hearings before the Subcomm. on Sci., Technol., and Space of the Comm. on Com., Sci. and Transportation, 97th Congr., 1st Sess., 10 and 19 Mar. 1981
(GPO-77-065-Pt-1) Avail: Subcommittee on Science, Technology, and Space

Accomplishments of NASA programs, with emphasis on Voyager Project and Space Shuttle, are detailed in NASA's funding appeal. Space Telescope and the Galileo Probe are included. S.F.

N81-27978# Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1982, PART 2
Washington GPO 1981 430 p refs Hearings before the Subcomm. on Sci. Technol. and Space of the Comm. on Com., Sci., and Transportation, 97th Congr., 1st Sess., 25, 31 Mar. and 7 and 27 Apr. 1981
(GPO-77-290) Avail: Subcommittee on Science, Technology, and Space

The decision to modify the Centaur for integration into the space shuttle for planetary and other high energy missions is examined as well as possible launch mechanisms for the Galileo project. International cooperation in space programs is considered with emphasis on the impact of budget cuts on Spacelab program agreements and possibilities and causes for cost over-runs and schedule delays in various NASA projects are discussed in relation to original forecasts. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N81-27979*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AUTOMATED MIXED TRAFFIC TRANSIT VEHICLE MICROPROCESSOR CONTROLLER Final Report, Mar. 1979 - Feb. 1981
R. A. Marks, P. Cassell, and A. R. Johnston 10 Feb. 1981 112 p refs Sponsored in cooperation with NASA
(Contract DOT-AT-60008T)
(NASA-CR-164538; JPL-Pub-81-24; UMTA-CA-06-0088-81-1)
Avail: NTIS HC A06/MF A01 CSCL 13F

An improved Automated Mixed Traffic Vehicle (AMTV) speed

control system employing a microprocessor and transistor chopper motor current controller is described and its performance is presented in terms of velocity versus time curves. The on board computer hardware and software systems are described as is the software development system. All of the programming used in this controller was implemented using FORTRAN. This microprocessor controller made possible a number of safety features and improved the comfort associated with starting and shopping. In addition, most of the vehicle's performance characteristics can be altered by simple program parameter changes. A failure analysis of the microprocessor controller was generated and the results are included. Flow diagrams for the speed control algorithms and complete FORTRAN code listings are also included. S.F.

N81-27980*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VEHICLE TEST REPORT: SOUTH COAST TECHNOLOGY ELECTRIC CONVERSION OF A VOLKSWAGEN RABBIT
T. W. Price, Thomas W. Shain, and James A. Bryant 15 Feb. 1981 181 p refs
(Contracts NAS7-100; DE-AI01-78CS-54209)
(NASA-CR-164532; JPL-Pub-81-28) Avail: NTIS HC A09/MF A01 CSCL 13F

The South Coast Technology Volkswagen Rabbit, was tested at the Jet Propulsion Laboratory's (JPL) dynamometer facility and at JPL's Edwards Test Station (ETS). The tests were performed to characterize certain parameters of the South Coast Rabbit and to provide baseline data that will be used for the comparison of near term batteries that are to be incorporated into the vehicle. The vehicle tests were concentrated on the electrical drive system; i.e., the batteries, controller, and motor. The tests included coastdowns to characterize the road load, maximum effort acceleration, and range evaluation for both cyclic and constant speed conditions. A qualitative evaluation of the vehicle was made by comparing its constant speed range performance with those vehicles described in the document 'state of the Art assessment of Electric and Hybrid Vehicles'. The Rabbit performance was near to the best of the 1977 vehicles. S.F.

N81-27981*# SRI International Corp., Menlo Park, Calif.
TECHNOLOGY TRANSFER: TRANSPORTATION Annual Report, 1 Jan. 1978 - 31 Dec. 1978
Tom Anyos, Lo Christy, Ruth Lizak, and James Wilhelm 31 Dec. 1978 98 p refs
(Contract NAS2-9846)
(NASA-CR-152673) Avail: NTIS HC A05/MF A01 CSCL 05A

The successful application of aerospace technology to problems related to highways and rail and rapid transit systems is described with emphasis on the use of corrosion resistant paints, fire retardant materials, and law enforcement. Possible areas for the use of spinoff from NASA technology by the California State Department of Corrections are identified. These include drug detection, security and warning systems, and the transportation and storage of food. A communication system for emergency services is also described. A.R.H.

N81-27982# California Univ., Livermore. Lawrence Livermore Lab. Transportation Systems Research.
ALUMINUM-AIR BATTERY FOR AUTOMOTIVE PROPULSION
John F. Cooper and Ervin Behrin Dec. 1980 21 p refs Presented at the Elec. and Hybrid Vehicle Advan. Technol. Seminar, Pasadena, Calif., 8 Dec. 1980
(Contract W-7405-eng-48)
(UCRL-85448; CONF-801242) Avail: NTIS HC A02/MF A01

The development of aluminum air batteries to be used in energy efficient, economical electric vehicles is reviewed with information on the research strategy, performance characteristics of aluminum air cells, vehicle design, and the net energy required and energy costs for producing and operating Al air batteries. Emphasis is placed on petroleum conservation in a time frame in which synthetic liquids will enter large scale production. The project is currently directed toward developing rapidly refuelable single cells. DOE

N81-27983# California Univ., Livermore. Lawrence Livermore Lab.
PRIVATE SECTOR TECHNOLOGY TRANSFER Final Report
Jan. 1981 11 p refs
(Contract W-7405-eng-48)
(UCRL-15342) Avail: NTIS HC A02/MF A01

A service which could represent the private sector in the federal laboratory consortium technology transfer process is described. Particular emphasis is placed on the value of the technology transfer and utilization to the private sector and small business community. DOE

N81-27984# Eagle-Picher Co., Joplin, Mo.
RESEARCH, DEVELOPMENT, AND DEMONSTRATION OF NICKEL-IRON BATTERIES FOR ELECTRIC VEHICLE PROPULSION Annual Technical Status Report
Mar. 1981 53 p refs Prepared for Argonne National Lab.
(Contract W-31-109-38-4292)
(ANL/OEPM-80-16; ATSR-3) Avail: NTIS HC A04/MF A01

A nickel iron battery was developed for use in the propulsion of electric and electric hybrid vehicles. The program concentrated on the characterization, fabrication and testing of the required electrodes, the fabrication and testing of full scale cells, and the fabrication and testing of full scale six volt modules. Electrodes of the final configuration exceeded 1880 cycles and show minimal capacity decline. Full scale cells exceeded 600 cycles and are tracking the individual electrode tests almost identically. Six volt module tests exceeded 500 cycles, with a specific energy of 48 Wh/kg. DOE

N81-27985# Energy Research Corp., Danbury, Conn.
RESEARCH, DEVELOPMENT, AND DEMONSTRATION OF NICKEL-ZINC BATTERIES FOR ELECTRIC VEHICLE PROPULSION Annual Report
Stanley Januszkiewicz, Hari Vaidyanathan, Mark Dodin, and Tony Leo Mar. 1981 243 p Prepared for Argonne National Lab.
(Contract W-31-109-4248)
(ANL/OEPM-80-13; AR-3) Avail: NTIS HC A11/MF A01

Progress in the development of nickel zinc batteries for electric vehicles is reported. Information is presented on nickel electrode preparation and testing; zinc electrode preparation with additives and test results; separator development and the evaluation of polymer blend separator films; sealed Ni-Zn cells; and the optimization of electric vehicle type Ni-Zn cells. DOE

N81-27986# Exide Management and Technology Co., Yardley, Pa.
RESEARCH, DEVELOPMENT, AND DEMONSTRATION OF NICKEL-ZINC BATTERIES FOR ELECTRIC VEHICLE PROPULSION Annual Report
Mar. 1981 134 p Prepared for Argonne National Lab.
(Contract W-31-109-38-4448)
(ANL/OEPM-80-15) Avail: NTIS HC A07/MF A01

Battery design and development, nickel cathode study, and electrochemical studies are reported. Battery design and development concentrated on the optimization of design parameters, including electrode spacing, charging methods, modules, and testing to verify these parameters. Initial experiments indicated that an interelectrode spacing of 2.5 mm is optimum when normal (dc) charging is used. Experiments on electrolyte concentration indicate that higher concentrations of KOH (8M, 9M or 10M) are beneficial to capacity maintenance. Available nickel cathodes were evaluated for possible use in the VIBROCEL. These included pocket, sintered plague impregnated, nickel plated steel wool impregnated, plastic bonded and CMG (multifoil) electrodes. DOE

N81-27987# Gould, Inc., Rolling Meadows, Ill.
RESEARCH, DEVELOPMENT, AND DEMONSTRATION OF NICKEL-ZINC BATTERIES FOR ELECTRIC VEHICLE PROPULSION Annual Report, 1 Sep. 1979 - 30 Sep. 1980
Mar. 1981 98 p Prepared for Argonne National Lab.
(Contract W-31-109-eng-38)
(ANL/OEPM-80-14; AR-3) Avail: NTIS HC A05/MF A01

Progress in developing nickel zinc batteries for propelling electric vehicles is reported. Information is included on component design, battery fabrication, and module performance testing. DOE

N81-27988# Oak Ridge National Lab., Tenn. Energy Div.
TRANSPORTATION ENERGY REQUIREMENTS TO THE YEAR 2010
Garland Samuels Apr. 1981 97 p refs
(Contract W-7405-eng-26)
(ORNL-5745) Avail: NTIS HC A05/MF A01

The potential reduction in energy use in the transportation sector through the year 2010 is studied in the contex of a strong national policy of conservation. Projections are made for efficiency improvements and demand growth for each transportation mode, and future energy requirements are derived. Electric vehicles are projected to be limited to short-range (< 150 km) applications. Although battery technology will probably advance to the point that longer-range (200 to 300 km) vehicles are practical, the additional weight and cost of the batteries will probably offset any energy or cost advantage for these vehicles. If coal becomes the primary fuel used, there appears to be little, if any, energy savings from using electricity as compared to converting the coal to synthetic liquid fuels. DOE

N81-27989# AiResearch Mfg. Co., Los Angeles, Calif.
NEAR-TERM ELECTRIC TEST VEHICLE ETV-2, PHASE 2 Final Report
Apr. 1981 320 p refs
(Contract DE-AC03-76CS-51213)
(DOE/CE-51213/01) Avail: NTIS HC A14/MF A01

A battery-powered passenger vehicle was developed that provides a significant improvement over conventional electric vehicle performance, particularly during stop-and-go driving. The vehicle is unique in two major respect: (1) the power system incorporates a flywheel that stores energy during regenerative braking and makes possible the acceleration capability needed to keep up with traffic without reducing range to unacceptable values; and (2) lightweight plastic materials are used for the vehicle unibody to minimize weight and increase range. These features were analyzed and demonstrated in an electric test vehicle, ETV-2. Characteristics of this vehicle are summarized. Information is presented on: vehicle design; fabrication; safety testing; and performance testing; power system design and operation; flywheel; battery pack performance; and controls and electronic equipment. DOE

N81-27990# Johnson Controls, Inc., Milwaukee, Wis. Globe Battery Div.
RESEARCH, DEVELOPMENT, AND DEMONSTRATION OF LEAD-ACID BATTERIES FOR ELECTRIC VEHICLE PROPULSION Annual Report
Donald E. Bowman Mar. 1981 92 p
(Contract W-31-109-eng-38)
(ANL/OEPM-80-12) Avail: NTIS HC A05/MF A01

Work performed for development of lead-acid batteries for electric vehicle propulsion is described. Design, materials and process development program results became evident in the achievement of the ISOA (Improved State of Art) specific energy, specific power, and energy efficiency goal can be met. Five modules were delivered to the National Battery Test Laboratory for capacity, power and life testing, and assembly is in progress of three full battery systems for installation in vehicles. DOE

N81-27991# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Abteilung Flugverkehrswissenschaft.
ESTIMATION OF THE DEMAND FOR TRANSPORTATION SERVICES IN 2000 WITH HIGH SPEED GROUND TRANSPORTATION SERVICES IN A EUROPEAN NETWORK
Paul-Juergen Weber Sep. 1980 112 p refs In GERMAN; ENGLISH summary
(DFVLR-RB-80-28) Avail: NTIS HC A06/MF A01

The demand for passenger transportation on high speed rail systems making up an extensive European intercity network is quantified, based on estimation models and possible scenarios. Traffic is assumed to move at speeds of 200 to 600 km/hr, i.e., magnetically levitated vehicles or high speed trains make up the transportation system. Results are shown for the percentage market distribution between public and private transportation. The traffic volume and annual passenger kilometers are also given for different future situations. Finally, questions of costs and revenues are briefly touched on. Author (ESA)

N81-27992# SRI International Corp., Menlo Park, Calif.
TECHNOLOGY CHOICES IN DEVELOPING COUNTRIES: PHASE 1 Final Report
Norman B. McEachron, Dorothy Leonard-Barton, Carl H. Gotsch, Gerald Schroff, Charles D. McConnell, Andrew Willard, and King Ming Young 29 Apr. 1980 266 p refs
(Grant NSF PRS-78-24042)
(PB81-168544; NSF/PRA-7824042) Avail: NTIS HC A12/MF A01 CSCL 05B

A conceptual framework was developed which reflects a systems approach to technology choice and identifies the crucial institutions influencing that choice in developing countries. The model is descried for a closed economy and its extension to an open economy with transnational interactions. It is based on an expected benefits matrix that specifies the net economic gain or loss that a particular interest group expects to receive from implementation of innovations. The model's application to the generation and choice of mechanical technology in agriculture, focusing on Pakistan, is demonstrated. Issues involved in the supply and choice of maufacturing technology in industry, including a discussion of the ferrous foundry industry in India, are examined. GRA

88 SPACE SCIENCES (GENERAL)

N81-27993# European Space Agency, Paris (France).
OPTICAL JETS IN GALAXIES
B. Battrick, comp. and J. Mort, comp. Mar. 1981 155 p refs In ENGLISH and FRENCH Proceedings of 2nd ESO/ESA Workshop on the Use of the Space Telescope and Co-ordinated Ground Based Res., Munich, 18-19 Feb. 1981 Prepared in cooperation with European Southern Observation, Munich
(ESA-SP-162; ISSN-0379-6566) Avail: NTIS HC A08/MF A01

Optical, X-ray and radio observations of jets in quasars, radio galaxies and other extragalactic sources are presented. Imaging techniques applicable to Large Space Telescope data are discussed. Collimated outflow from various objects is considered. Models of jets are surveyed in light of recent observations. For individual titles, see N81-27994 through N81-28018.

N81-27994# Leiden Univ. Observatory (Netherlands). Huygens Lab.
JETS AND THE SPACE TELESCOPE: AN INTRODUCTION **c89**
George K. Miley *In* ESA Opt. Jets in Galaxies Mar. 1981 p 9-13 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

Jets in active galaxies are prime targets for the Space Telescope (ST). They occur on length scales ranging from smaller than a parsec to almost a megaparsec. There appears to be a close association between the narrow line region and radio jet structure on the kiloparsec scale. The angular resolution of the ST will be ideal for studying these kiloparsec sized components. Complementary radio observations are essential if the unique capability of the ST is to be exploited fully. Radio telescopes having resolution comparable to the ST are listed. Author (ESA)

N81-27995# European Space Research and Technology Center, Noordwijk (Netherlands). ESA Space Science Dept.
THE SPACE TELESCOPE **c89**
F. Macchetto *In* ESA Opt. Jets in Galaxies Mar. 1981 p 15-21 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

The characteristics of the Space Telescope (ST) and the five accompanying scientific instruments are reviewed with an emphasis upon the study of jets in galaxies. The capabilities of the wide field and planetary camera, faint object camera, faint object and high resolution spectrographs and the high speed photometer are reviewed. The ST will be an ideal instrument for studying jets because of the ultraviolet capability and stability of the photometric response of all instruments on extremely small angular scales. Author (ESA)

N81-27996# Kitt Peak National Observatory, Tucson, Ariz.
IMAGING OBSERVATIONS OF OPTICAL EMISSION FROM JETS **c74**
H. R. Butcher *In* ESA Opt. Jets in Galaxies Mar. 1981 p 23-24 refs Sponsored by NSF (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

A ground-based survey for optical counterparts to radio jets is described. Present detection limits are consistent with all radio jets having continuous spectra into the optical with spectral indices near -0.7. A list was compiled of some 33 nearby radio jet galaxies, using published and unpublished radio maps from the Westerbork, Cambridge, Greenbank and VLA interferometers. A selection of these objects, was examined starting with those having the brightest radio jets, using the digital imaging TV system at Kitt Peak (the so-called Video Camera) on the Mayall 4 m telescope. The resulting sample of jets available for study from the ground is small, and significant observational progress in defining jet characteristics under different physical conditions will require use of the Space telescope. Author (ESA)

N81-27997# European Space Research and Technology Center, Noordwijk (Netherlands). ESA Space Science Dept.
THE OPTICAL JET IN M87: DECONVOLUTION BY MAXIMUM ENTROPY **c89**
M. A. C. Perryman *In* ESA Opt. Jets in Galaxies Mar. 1981 p 25-28 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

Deconvolution of astronomical images by the method of maximum entropy is described and the algorithm applied to observations of the optical jet in M87. The importance of the application of such techniques to data obtained with the Space Telescope is emphasized. The chi squared statistic is used to indicate the quality of the fit, and the configurational entropy is used to identify the most likely trial map from all those giving similar values of chi squared. The noise residuals are further constrained to match their known statistical distribution. The deconvoluted image is in good qualitative agreement with the structure seen on high resolution very large array radio maps at 5 and 15 GHz. Author (ESA)

N81-27998# Observatoire de Paris-Meudon (France).
OPTICAL JETS IN ELLIPTIC GALAXIES, N GALAXIES, AND BL LACERTAE TYPE OBJECTS [JETS OPTIQUES DANS LES GALAXIES ELLIPTIQUES, LES GALAXIES N ET LES OBJETS DE TYPE BL LACERTAE] **c89**
G. Wlerick *In* ESA Opt. Jets in Galaxies Mar. 1981 p 29-35 refs In FRENCH (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

Electronographic studies of optical jets were carried out using U color, V color and V' color (620 nm) photography with exposures of the order of 20 min. Isophotes were obtained by image processing using various computer programs. The condensation flash of the M87 galaxy jet was measured in U color. A filamentary radial and rectilinear jet was observed in the PKS 0521-36 object. A known perturbation NW of the 3C120 galaxy is found to originate west of the nucleus and shows continuous emission. This is the first observation of a jet changing direction. It is concluded that electronography is well adapted to jet studies, with 1 to 30 million pixels-having been obtained. Author (ESA)

N81-27999# Kitt Peak National Observatory, Tucson, Ariz.
SPECTROSCOPIC EVIDENCE FOR COLLIMATED OUTFLOW **c93**
H. R. Butcher *In* ESA Opt. Jets in Galaxies Mar. 1981 p 39-41 refs Sponsored by NSF (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

Recent optical observations of several nearby radio sources are discussed. At present, optical evidence for collimated outflow is mostly indirect, involving the results of interactions of radio emitting plasma with interstellar material. Spectra from M87 indicate a filament nearly at rest and hence a condensation rather than material being ejected from the nucleus. The optical condensations along the radio axis of Cen A may be another example. One case of simultaneous ejection of thermal and relativistic plasmas has apparently been found, 3C 305. Optical and radio maps are similar and polarization data indicates that where the two maps overlap the 5 GHz polarization is 1%; where the radio emission extends beyond the optical, values as high as 30% are reached. Author (ESA)

N81-28000# Observatoire du Pic-du-Midi (France).
HIGH RESOLUTION ELECTROGRAPHS OF THE M87 JET **c90**
J.-L. Nieto, J.-L. Vidal, P. Laques, A. Auge, and R. Despiau *In* ESA Opt. Jets in Galaxies Mar. 1981 p 43-44 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

A set of electrographic plates in the V band was obtained on January 8, 1981 with the Lallemand electrographic camera attached to the 106 cm reflector of Pic du Midi observatory. The plates show that the two brightest knots A and B are clearly separated, before any deconvolution, and the jet is linear between the center and its brightest part (A, B complex). The C complex seems to be slightly off-axis so that the whole jet appears S-shaped. The optical morphology of the jet is strikingly similar to the Very Large Array map at 2 cm. Author (ESA)

N81-28001# Royal Observatory, Edinburgh (Scotland).
NEW OPTICAL AND RADIO DATA ON THE OUTER PARTS OF CENTAURUS A **c89**
R. D. Cannon *In* ESA Opt. Jets in Galaxies Mar. 1981 p 45-47 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

Deep photographs of NGC 5128 (Cen A) taken on the UK 1.2m Schmidt telescope are presented which show very faint diffuse extensions aligned approximately with the radio lobes. However, the optical isophotes and radio contours do not coincide exactly. The position angle varies with distance from the nucleus for a series of X-ray, optical and radio features in the NE quadrant, perhaps indicating precession of the central source. The faint optical extensions have colors similar to those of the main body of the galaxy, and may consist either of stars or dust. The Space Telescope should be useful for detailed study of discrete wisps and knots, and for the discovery of similar features in more distant radio galaxies. Author (ESA)

N81-28002# Royal Observatory, Edinburgh (Scotland).
THE OPTICAL JETS OF MGC 1097 **c89**
Ramon D. Wolstencroft *In* ESA Opt. Jets in Galaxies Mar. 1981 p 49-51 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

The optical and radio properties of the four jets of this barred spiral galaxy are reviewed and their origin is discussed. The optical jet are held to be collimated outflow from the nucleus rather than the result of tidal interaction between the galaxy and its companion. Observations indicate that the jets do not radiate by the synchrotron mechanism. The difficulties of reconciling this fact with the collimated outflow model are discussed. The need for further optical observations is stressed. Author (ESA)

N81-28003# Mount Wilson Observatory, Pasadena, Calif.
JETS IN 3C73 AND OTHER EXTRAGALACTIC OBJECTS **c89**
H. Arp *In* ESA Opt. Jets in Galaxies Mar. 1981 p 53-61 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

Photographic and radio observations of the quasar 3C273 and its jet are discussed. A knot appears at the base of the jet and there seems to be reddening towards the tip of the jet. The reddening is supported by radio observations. The problem of apparent superluminal expansion is mentioned with 3C273 and 3C120. Emission features are reported on the continuum of knot C in the M87 jet. An observation of a faint star at the end of the jet in 3C66B is reported as having a continuum with no identifiable features. The question of the distance of NGC 4448, and 3C273 is raised. Author (ESA)

N81-28004# Kitt Peak National Observatory, Tucson, Ariz.
OPTICAL EMISSION FROM THE EXTENDED RADIO SOURCE 3C 277.3 (COMA A) **c93**

Wil vanBreugel *In* ESA Opt. Jets in Galaxies Mar. 1981 p 63-67 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

Optical emission was detected both from the radio jet and from the outer lobe regions of the radio galaxy 3C 277.3 (Coma A) at a redshift of 0.0857. Two optical continuum knots are seen in the jet, the brighter of which is found to be 12% polarized with the magnetic vector along the jet. Intense optical emission lines were observed from the knot region of the jet and from regions near the peripheries of the radio lobes. Evidence is presented that this line-emitting gas, which extends over distances of 60 kpc, is related to the gas responsible for the depolarization of the radio continuum. The measurements of line strengths are used to place constraints on the physical conditions in this gas and rule out heating in shocks as the dominant source of energy input in the region of the jet. The gas is shown to be moving at velocities of up to a few hundred kilometers per second with respect to the nucleus. The origin of this gas and the possibility of using its velocity distribution to trace the kinematics of the relativistic plasma are discussed. Author (ESA)

N81-28005# Radio Sterrenwacht, Westerbork (Netherlands).
RECENT OBSERVATIONS OF LARGE ANGULAR SIZE RADIO JETS **c93**
A. G. Willis *In* ESA Opt. Jets in Galaxies Mar. 1981 p 71-76 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

Various properties of radio jets having projected angular sizes of more than a few arcseconds are summarized. Their intrinsic projected sizes range up to 290 kpc. Their radio spectra tend to be flatter than the spectra of the integrated emission of the sources with which they are associated. Jet wiggles, gaps, magnetic field structures, collimation and alignment are discussed. The bulk flow velocity of material in these jets is probably nonrelativistic. Jets may be a more dominant morphological feature in low luminosity radio sources than in high luminosity sources. Mechanisms by which energy is supplied to the outer lobes of radio sources are discussed, including energy supply by both relativistic and nonrelativistic material. Author (ESA)

N81-28006# National Radio Astronomy Observatory, Socorro, N. Mex.
RADIO JETS IN FLAT-SPECTRUM SOURCES **c93**
R. A. Perley *In* ESA Opt. Jets in Galaxies Mar. 1981 p 77-81 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

Flat spectrum sources are characterized by complex spectra, flux variability and small angular size. The extended structure of compact sources can be summarized as follows: (1) at least 30% of compact sources contain nearby associated extended emission; (2) the range of structures found is very broad, with haloes, jets and blobs often present simultaneously; (3) the structure is much more asymmetric than steep spectrum sources, with the flux ratios between opposite lobes usually exceeding 5:1, and often exceeding 20:1; (4) haloes are found in only a few sources; and (5) The position angle is within 20 deg of the very long base core structure in those sources where the latter information is available. In two sources (3C345 and 3C454.3) bridges smoothly linking the milliarcsecond and arcsecond structures are seen. The compact sources are likely to represent an early evolutionary phase in the life of a radio source.
Author (ESA)

N81-28007# Netherlands Foundation for Radio Astronomy, Dwingelo. Dwingeloo Radio Observatory.
THE LARGE RADIO GALAXY DA 240: EVIDENCE FOR JETS? **c90**
R. G. Strom and A. G. Willis *In* ESA Opt. Jets in Galaxies Mar. 1981 p 86-86 refs Sponsored by Netherlands Organisation for the Advancement of Pure Research (ZWO) (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

Optical and radio observations of DA 240 are presented which suggest that there is a collimated structure in its outer components. A probable morphological connection is noted between the outer radio emission and the optical jet in the central galaxy MCG 9-13-57. This system and NGC 5128/Cen A have striking features in common including a strong indication that the gas flowing in the jet contains thermal material and is moving nonrelativistically. The fact that optical jets are narrow, often embedded in diffuse emission and include a blue continuum gives the Space Telescope clear advantages over ground based instruments. Author (ESA)

N81-28008# Nuffield Radio Astronomy Labs., Jodrell Bank (England).
OBSERVATIONS OF CORE DOMINATED SOURCES WITH THE MULTI TELESCOPE RADIO LINKED INTERFEROMETER (MTRLI) **c89**
I. W. A. Browne and M. J. L. Orr *In* ESA Opt. Jets in Galaxies Mar. 1981 p 87-89 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

Maps of core-dominated sources were made at 408 and 1666 MHz with the Jodrell Bank MTRLI. These maps show that many such sources have clearly defined jets, in addition to compact cores and regions of diffuse emission. The hypothesis is adopted that core dominated sources are seen end-on. It is argued that if Doppler beaming models offer a true explanation of the core properties, then the jets are moving relativistically, and core-dominated and classical double quasars are one and the same type of object. Author (ESA)

N81-28009# Consiglio Nazionale delle Ricerche, Bologna (Italy). Ist. di Radioastronomia.
JETS IN A SAMPLE OF LOW LUMINOSITY RADIO GALAXIES **c93**
R. Fanti and P. Parma *In* ESA Opt. Jets in Galaxies Mar. 1981 p 91-95 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

A sample of low luminosity radio galaxies was obtained by identifying radio sources from the B2 catalog with galaxies from the Zwicky catalog. For all 40 galaxies of the sample observations were done at 5, 1.4 and 0.6 GHz with the Westerbork Synthesis Radio Telescope (WSRT), using the technique of short cuts. The sources with complex structure and with too low surface brightness were reobserved at WRST for 12 hours at 1.4 or at 5 GHz. In a large number of these sources jets were detected (9 out of 17). The low luminosity radiosource B2 1321+31 is emphasized. In some regions in the jet the brightness and polarization data suggest that the flow velocity along the jet decreases.
Author (ESA)

N81-28010# Max-Planck-Institut fuer Radioastronomie, Bonn (West Germany).
VERY LONG BASELINE INTERFEROMETRY (VLBI) OBSERVATIONS OF JETS AND ACTIVE NUCLEI **c89**
E. Preuss *In* ESA Opt. Jets in Galaxies Mar. 1981 p 97-105 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

The instrumental performance of current VLBI relevant to astronomical observations is reviewed. Tables of all published VLBI observations of extragalactic objects from 1975 to Feb. 1981 are presented. Optical type, Miley's classification (Di or D2), and minimum and maximum observing wavelength are included. The statistics of bright sources mapped or detected by VLBI are presented, and also for size, brightness, time dependence and symmetry. The evidence from recent VLBI mapping with higher dynamic range appears to be very suggestive of a model for the stronger radio sources involving beam speeds near c. The very compact, asymmetric structures seen by VLBI can be explained by the relativistic twin jet beam model. The bright core is identified with the source of the beam, the jet-like feature with the beam itself. The curvature in compact jets is due to amplification by projection effects. Apparent superluminal motion is the kind of evidence which calls for relativistic bulk motion.
Author (ESA)

N81-28011# Netherlands Foundation for Radio Astronomy, Dwingelo. Dwingeloo Radio Observatory.
JETLIKE RADIOSTRUCTURE IN THE CORE OF 3C236 **c93**
R. T. Schilizzi, G. K. Miley (Sterrenwacht Leiden), F. L. J. Jansen (Sterrenwacht Leiden), P. N. Wilkinson (Nuffield Radio Astron. Lab.), T. J. Cornwell (Nuffield Radio Astron. Lab.), and E.B.

Fomalont (Natl. Radio Astron. Obs., Charlottesville, Va.) *In* ESA Opt. Jets in Galaxies Mar. 1981 p 107-108 refs (For primary document see N81-27993 18-88)
(Grant NATO-1828)
Avail: NTIS HC A08/MF A01

The fine structure of the core was studied using very long baseline interferometry observations at 18 cm using Effelsberg, Dwingeloo and Jodrell Bank together with a transatlantic baseline to Green Bank. A preliminary hybrid map is shown with a restoring beam appropriate to the European baselines. Although the calibration of the data are not yet complete, the following preliminary conclusions can be drawn: (1) the steep spectrum core of 3C 236 resembles the jet-like structures seen in many sources on a much larger scale; (2) although the overall extension of the core agrees with that of the outer lobes the existence of non-linear fine structure in the core is confirmed; (3) the bending observed in the south eastern region of the jet resembles the wiggles often seen in larger jets; and (4) there is a gradual change in position angle by 25 deg. From the eastern to the western regions of the core. Author (ESA)

N81-28012*# Center for Astrophysics, Cambridge, Mass.
X-RAY OBSERVATIONS OF JETS c89
Ethan J. Schreier *In* ESA Opt. Jets in Galaxies Mar. 1981 p 109-114 refs (For primary document see N81-27993 18-88)
(Contract NAS8-30751)
Avail: NTIS HC A08/MF A01

The current status of X-ray emission from jets, as observed by the Einstein X-ray Observatory, is reviewed. The X-rays were detected from the jets of 3C273, M87, and Centaurus A. Preliminary results from VLA observations of the Centaurus A jet are also discussed. In all three cases, the data indicate synchrotron radiation, with the spectral index breaking in the range of 10 to the 14th power to 10 to the 15th power Hz; in situ acceleration of the relativistic electrons is required, since the electron lifetimes are significantly shorter than the light travel times from the nucleus. Thermal confinement of the jets is possible in some but not all regions. Author (ESA)

N81-28013# European Southern Observatory, Munich (West Germany).
X-RAY EMISSION FROM THE RADIO GALAXY 3C 66B c93
M. Tarenghi and D. Maccagni (CNR, Milan) *In* ESA Opt. Jets in Galaxies Mar. 1981 p 115-116 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

The field of 3C66B was observed by the Imaging Proportional Counter of the Einstein Observatory. The 1979 observation yields a contour plot of data showing an elongation of the image of 3C 66B in the NE direction, while the image of 3C 66A is quite symmetric. The same elongation is found in the 1980 observation of the same field; also in this case the X-ray image of 3C 66A is symmetric and furthermore the intensities of the two sources are comparable, thus excluding that the difference in the images is due to photon statistics. The X-ray emission of 3C 66B is held to be due to activity in the nuclear region rather than to thermal bremsstrahlung from hot ga around the galaxy, and a jet which has properties similar to the M87 jet. Author (ESA)

N81-28014# Turin Univ. (Italy). Ist. di Fisica Generale.
OPTICAL JETS AND BEAM MODELS OF EXTENDED RADIO SOURCES c93
A. Ferrari, E. Trussoni, and L. Zaninetti *In* ESA Opt. Jets in Galaxies Mar. 1981 p 119-123 refs Prepared in cooperation with CNR, Milan (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

Theoretical models about the morphology and optical nonthermal emission of galactic jets are discussed, mainly referring to the case of M 87. It is shown that observed physical features can be related to the dynamical interaction of the jet moving through the intracluster gas. Dense clouds or large scale unstable perturbations can explain the structure of the blobs, while nonthermal high frequency radiation can be due to synchroton emission by electrons accelerated in turbulent plasmas or in shock fronts. Author (ESA)

N81-28015# Maryland Univ., College Park. Astronomy Program.
COLLIMATED EJECTION OF RADIO EMITTING MATERIAL IN SEYFERT GALAXIES c93
A. S. Wilson *In* ESA Opt. Jets in Galaxies Mar. 1981 p 125-130 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

Very large array maps of six Seyfert Galaxies are presented which show double (or triple) radio structures, with two radio components straddling the optical continuum nucleus and a third, when present, coincident with it. The scales of the double sources lie in the range a few hundred parsecs to a few kiloparsecs. It is argued that these doubles represent ejection from the inner nucleus, either as plasmoids or a particle beam, followed by stopping or beam disruption by surrounding interstellar gas in the inner region of the galaxy. The broadened forbidden optical emission lines in these galaxies may originate in interstellar clouds accelerated by the hypothetical particle beam. Such a model is probably also relevant to thermal knots inside the jets of radio galaxies and to other active ellipticals, especially those containing steep spectrum radio sources and shock excited emission line spectrum. Author (ESA)

N81-28016# Royal Observatory, Edinburgh (Scotland).
OPTICAL JETS IN ACTIVE GALAXIES c93
M. S. Longair *In* ESA Opt. Jets in Galaxies Mar. 1981 p 133-135 (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

The astrophysical importance of jets is pointed out. The origin of jets is inferred to be deep within galactic nuclei and any satisfactory theory of active nuclei must explain naturally the occurrence of such phenomena. Jets act as diagnostic probes of the ambient interstellar and intergalactic media. The evolution of theoretical work pertaining to jets incuding the adiabatic loss problem and the confinement problem is traced. The need for further study in the collimation of jets and particle acceleration is pointed out. Mechanisms explaining the abrupt discontinuittes in jets are suggested. Observational programs for the Space Telescope are listed. Author (ESA)

N81-28017# European Southern Observatory, Munich (West Germany).
OPTICAL PROPERTIES OF THE JET IN NGG 5128 c74
I. J. Danziger *In* ESA Opt. Jets in Galaxies Mar. 1981 p 143-144 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

Observational work concerning the outer features, the inner jet and the amorphous gaseous component of NGC 5128 jet is reviewed. Some condensations have spectra which are similar to those observed in photoionized HII regions. The nitrogen [NII] line strengths are sufficiently great to rule out the possibility that the material is very metal-poor and therefore primordial in origin. Some knots have spectral properties which are quite distinct from those of normal photoionized HII regions. The velocity data still require clarification. All the available velocities of these features are smaller (i.e., less positive) than the systemic velocity of NGC 5128. The inner jet-like features align with the X-ray jet inferring a connection between the two. The peculiar emission seen in the outer jet and in the amorphous gaseous regions closer to the nucleus may result from the exposure of the material to the hot nonthermal nucleus. Author (ESA)

N81-28018# European Southern Observatory, Munich (West Germany).
OLD AND NEW OBSERVATIONS OF THE M87 JET c89
Massimo Tarenghi *In* ESA Opt. Jets in Galaxies Mar. 1981 p 145-151 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

Data on the electromagnetic spectrum of the jet are reviewed, and the importance of the Space Telescope for its study indicated. It is difficult to determine the stellar magnitude of the jet by any method because it is observed on the bright background of the galaxy. It is not certain if the jet is a pure sequence of knots or if the knots are following a luminous stream. A change in the polarization and the intensity of the jet in 22 years is noted. High and low resolution spectra of the jet are presented. The emission lines of the nucleus present clear, complex profiles in the high resolution spectra, but no evidence

of emission is present on the spectrum of the jet (knots A and B). The jet in the red region of the spectrum is very faint, but it is comparable to the nucleus in the UV. Author (ESA)

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N81-28019 British Library Lending Div., Boston Spa (England).
THE STELLAR COMPOSITION IN REGIONS OF O-ASSOCIATIONS CYGNUS OB4, CEPHEUS-LACERTA OB1 AND CASSIOPEIA OB9
Tsvetana S. Radoslavova Nov. 1980 12 p refs Transl. into ENGLISH from Star Cluster Symp. (Budapest), 1977 p 29-37 Conf. held in Budapest, 1977
(BLL-RTS-12328) Avail: British Library Lending Div., Boston Spa, Engl.

A stellar distribution was made according to spectral and luminosity classes. Three areas of sky were explored. Proceeding from the assumption that a correlation exists between the age of a given star group and the number of hot stars and emission objects in it, it is concluded that the stellar population in the second sky area is of more recent origin than the third. The stellar population in the first area was evidently formed at an earlier time than the others. S.F.

N81-28020*# Arizona Univ., Tucson.
TEST RESULTS OF SPACELAB 2 INFRARED TELESCOPE FOCAL PLANE Final Report
E. T. Young (Steward Observatory), G. H. Rieke (Steward Observatory), T. N. Gautier (Steward Observatory), W. F. Hoffmann (Steward Observatory), F. J. Low (Steward Observatory), W. Poteet (Steward Observatory), G. G. Fazio (Smithsonian Astrophysical Observatory), D. Koch (Smithsonian Astrophysical Observatory), W. A. Traub (Smithsonian Astrophysical Observatory), E. W. Urban et al [1981] 8 p refs
(Contract NAS2-10436)
(NASA-TM-80456; Rept-280-2) Avail: NTIS HC A02/MF A01 CSCL 03A

The small helium cooled infrared telescope for Spacelab 2 is designed for sensitive mapping of extended, low-surface-brightness celestial sources as well as highly sensitive investigations of the shuttle contamination environment (FPA) for this mission is described as well as the design for a thermally isolated, self-heated J-FET transimpedance amplifier. This amplifier is Johnson noise limited for feedback resistances from less than 10 to the 8th power Omega to greater than 2 x 10 to the 10th power Omega at T = 4.2K. Work on the focal plane array is complete. Performance testing for qualification of the flight hardware is discussed, and results are presented. All infrared data channels are measured to be background limited by the expected level of zodiacal emission. A.R.H.

N81-28021# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Raumfahrt.
CONCEPT AND FEASIBILITY STUDY: DESIGN OF A BAEZ X-RAY TELESCOPE Final Report
Ernst Blenninger, Wolfgang Brunner, Ulrich Kipnich, Ernst Sach, Walter Schnindler, Gerd Tybus, Hans Wolter, and Ererhard Wunderer Bonn Bundesministerium fuer Forschung und Technologie Dec. 1980 88 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-80-003; ISSN-0170-1339) Avail: NTIS HC A05/MF A01

The design of the BAFZ telescope is described. It is based on the principle of total reflection of X-rays at grazing incidence. The reflecting mirrors consist of two successive and orthogonal sets of slightly shaped parabolic mirrors which are extremely thin to guarantee highest possible efficiency of the system. The feasibility of producing very thin X-ray reflecting mirrors at the present state of the art is demonstrated. Samples were manufactured and a quarter section was fabricated with three X-ray reflecting parabolic shaped mirrors 300 x 220 mm in size. Furthermore, test results show that the proposed design can withstand environmental loads experienced at launch by rocket or shuttle. Author (ESA)

N81-27124*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADIO ASTRONOMY
R. D. Shaffer, P. R. Wolken, and S. Gulkis *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 1-2 (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 03A

N81-27149*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PLANETARY RADAR
R. D. Shaffer, P. R. Wolken, and R. F. Jurgens *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1981 p 226 (For primary document see N81-27123 18-12)
Avail: NTIS HC A11/MF A01 CSCL 03A

N81-27994# Leiden Univ. Observatory (Netherlands). Huygens Lab.
JETS AND THE SPACE TELESCOPE: AN INTRODUCTION
George K. Miley *In* ESA Opt. Jets in Galaxies Mar. 1981 p 9-13 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

N81-27995# European Space Research and Technology Center, Noordwijk (Netherlands). ESA Space Science Dept.
THE SPACE TELESCOPE
F. Macchetto *In* ESA Opt. Jets in Galaxies Mar. 1981 p 15-21 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

N81-27997# European Space Research and Technology Center, Noordwijk (Netherlands). ESA Space Science Dept.
THE OPTICAL JET IN M87: DECONVOLUTION BY MAXIMUM ENTROPY
M. A. C. Perryman *In* ESA Opt. Jets in Galaxies Mar. 1981 p 25-28 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

N81-27998# Observatoire de Paris-Meudon (France).
OPTICAL JETS IN ELLIPTIC GALAXIES, N GALAXIES, AND BL LACERTAE TYPE OBJECTS [JETS OPTIQUES DANS LES GALAXIES ELLIPTIQUES, LES GALAXIES N ET LES OBJETS DE TYPE BL LACERTAE]
G. Wlerick *In* ESA Opt. Jets in Galaxies Mar. 1981 p 29-35 refs In FRENCH (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

N81-28001# Royal Observatory, Edinburgh (Scotland).
NEW OPTICAL AND RADIO DATA ON THE OUTER PARTS OF CENTAURUS A
R. D. Cannon *In* ESA Opt. Jets in Galaxies Mar. 1981 p 45-47 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

N81-28002# Royal Observatory, Edinburgh (Scotland).
THE OPTICAL JETS OF MGC 1097
Ramon D. Wolstencroft *In* ESA Opt. Jets in Galaxies Mar. 1981 p 49-51 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

N81-28003# Mount Wilson Observatory, Pasadena, Calif.
JETS IN 3C73 AND OTHER EXTRAGALACTIC OBJECTS
H. Arp *In* ESA Opt. Jets in Galaxies Mar. 1981 p 53-61 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

N81-28008# Nuffield Radio Astronomy Labs., Jodrell Bank (England).
OBSERVATIONS OF CORE DOMINATED SOURCES WITH THE MULTI TELESCOPE RADIO LINKED INTERFEROMETER (MTRLI)
I. W. A. Browne and M. J. L. Orr *In* ESA Opt. Jets in Galaxies Mar. 1981 p 87-89 refs (For primary document see N81-27993

18-88)
Avail: NTIS HC A08/MF A01

N81-28010# Max-Planck-Institut fuer Radioastronomie, Bonn (West Germany).
VERY LONG BASELINE INTERFEROMETRY (VLBI) OBSERVATIONS OF JETS AND ACTIVE NUCLEI
E. Preuss *In* ESA Opt. Jets in Galaxies Mar. 1981 p 97-105 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

N81-28012*# Center for Astrophysics, Cambridge, Mass.
X-RAY OBSERVATIONS OF JETS
Ethan J. Schreier *In* ESA Opt. Jets in Galaxies Mar. 1981 p 109-114 refs (For primary document see N81-27993 18-88) (Contract NAS8-30751)
Avail: NTIS HC A08/MF A01

N81-28018# European Southern Observatory, Munich (West Germany).
OLD AND NEW OBSERVATIONS OF THE M87 JET
Massimo Tarenghi *In* ESA Opt. Jets in Galaxies Mar. 1981 p 145-151 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N81-28022*# California Univ., Berkeley. Lawrence Berkeley Lab.
AETHER DRIFT AND THE ISOTROPY OF THE UNIVERSE: A MEASUREMENT OF ANISOTROPES IN THE PRIMORDIAL BLACK-BODY RADIATION Final Report, 1 Nov. 1978 - 31 Oct. 1980
George F. Smoot 23 Jul. 1981 18 p Sponsored by NASA. Ames Research Center
(NASA-CR-164424; SSL-Ser-22-Issue-16) Avail: NTIS HC A02/MF A01 CSCL 03B

Large-angular-scale anisotropies in the 3 K primordial black-body radiation were detected and mapped with a sensitivity of 2 x to the minus 4 power K and an angular resolution of about 10 deg. The motion of the Earth with respect to the distant matter of the Universe ('Aether Drift') was measured and the homogeneity and isotropy of the Universe (the 'Cosmological Principle') was probed. The experiment uses two Dicke radiometers, one at 33 GHz to detect the cosmic anisotropy, and one at 54 GHz to detect anisotropies in the residual oxygen above the detectors. The system was installed in the NASA-Ames Earth survey aircraft (U-2), and operated successfully in a series of flights in both the Northern and Southern Hemispheres. Data taking and analysis to measure the anisotropy were successful. A.R.H.

N81-28023# Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics.
THE THICKNESS OF THE INTERPLANETARY COLLISIONLESS SHOCK WAVES
S. Pinter May 1980 30 p refs
(KFKI-1980-27; ISBN-963-371-656-X) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

The thickness of magnetic structures of the interplanetary shock waves related to the upstream solar wind plasma parameters are studied. The following results were obtained: the measured shock thickness increase for decreasing upstream proton number density and decreases for increasing proton flux energy. The shock thickness strongly depends on the ion plasma (alpha); i.e., for higher values of the the thickness decreases. DOE

N81-28000# Observatoire du Pic-du-Midi (France).
HIGH RESOLUTION ELECTROGRAPHS OF THE M87 JET
J.-L. Nieto, J.-L. Vidal, P. Laques, A. Auge, and R. Despiau *In* ESA Opt. Jets in Galaxies Mar. 1981 p 43-44 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

N81-28007# Netherlands Foundation for Radio Astronomy, Dwingelo. Dwingeloo Radio Observatory.
THE LARGE RADIO GALAXY DA 240: EVIDENCE FOR JETS?
R. G. Strom and A. G. Willis *In* ESA Opt. Jets in Galaxies Mar. 1981 p 86-86 refs Sponsored by Netherlands Organisation for the Advancement of Pure Research (ZWO) (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N81-28024*# Planetary Science Inst., Tucson, Ariz.
PLANETARY GEOLOGICAL STUDIES Final Report
Karl R. Blasius 28 Feb. 1981 21 p refs
(Contract NASw-3208)
(NASA-CR-164555) Avail: NTIS HC A02/MF A01 CSCL 03B

A global data base was assembled for the study of Mars crater ejecta morphology. The craters were classified as to morhology using individual photographic prints of Viking orbiter frames. Positional and scale information were derived by fitting digitized mosaic coordinates to lattitude-longitude coordinates of surface features from the Mars geodetic control net and feature coordinates from the U.S.G.S. series of 1:5,00,000 scale shaded relief maps. Crater morphology characteristics recorded are of two classes - attributes of each ejecta deposit and other crater charactersitics. Preliminary efforts to check the data base with findings of other workers are described. A.R.H.

N81-28025*# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research.
RADAR INVESTIGATION OF ASTEROIDS Research Proposal, 1 Nov. 1981 - 31 Oct. 1982
Steven J. Ostro Jul. 1981 25 p refs
(Grant NAGw-116)
(NASA-CR-164554; SSN-138-38-2642) Avail: NTIS HC A02/MF A01 CSCL 03B

Radar investigations were conducted of selected minor planets, including: (1) observations during 1981-82 of 10 potential targets (2 Pallas, 8 Flora, 12 Victoria, 15 Eunomia, 19 Fortuna, 22 Kalliope, 132 Aethra, 219 Thusnelda, 433 Eros, and 2100 Ra-Shalom); and (2) continued analyses of observational data obtained during 1980-81 for 10 other asteroids (4 Vesta, 7 Iris, 16 Psyche, 75 Eurydike, 97 Klotho, 216 Kleopatra, 1685 Toro, 1862 Apollo, 1865 Cerberus, and 1915 Quetzalcoatl). Scientific objectives include estimation of echo strength, polarization, spectral shape, spectral bandwidth, and Doppler shift. These measurements: (1) yield estimates of target size, shape, and spin vector; (2) place constraints on topography, morphology, and composition of the planetary surface; (3) yield refined estimates of target orbital parameters; (4) reveal the presence of asteroidal satellites. S.F.

N81-28026*# Lowell Observatory, Flagstaff, Ariz.
A PHOTOMETRIC INVESTIGATION OF COMET P/ENCKE Final Report
Robert L. Millis 30 Jun. 1981 12 p refs Sponsored by NASA Prepared for JPL
(Contract JPL-BP-724891)
(NASA-CR-164580; JPL-9950-565; Rept-1) Avail: NTIS HC A02/MF A01 CSCL 03B

A photometric investigation of Comet P/Encke was undertaken using the 2.2 m telescope and the 0.6 m telescope. The two primary scientific objectives were: (1) measurement of the production rates of OH, CN, C3, and C2 as a function of heliocentric distance; and (2) determination of the comet's rotational period by searching for periodic brightness variations in the inner coma.

Synoptic observation in the Canary Islands; Cambridge, Massachusetts; Flagstaff, Arizona; and Mauna Kea were planned for the study of the comet's rotaton. E.A.K.

N81-28027*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

MARS SAMPLE RETURN: SITE SELECTION AND SAMPLE ACQUISITION STUDY

Neil Nickle, ed. 1 Nov. 1980 49 p refs
(Contract NAS7-100)
(NASA-CR-164558; JPL-Pub-80-59) Avail: NTIS HC A03/MF A01 CSCL 03B

Various vehicle and mission options were investigated for the continued exploration of Mars; the cost of a minimum sample return mission was estimated; options and concepts were synthesized into program possibilities; and recommendations for the next Mars mission were made to the Planetary Program office. Specific sites and all relevant spacecraft and ground-based data were studied in order to determine: (1) the adequacy of presently available data for identifying landing sities for a sample return mission that would assure the acquisition of material from the most important geologic provinces of Mars; (2) the degree of surface mobility required to assure sample acquisition for these sites; (3) techniques to be used in the selection and drilling of rock a samples; and (4) the degree of mobility required at the two Viking sites to acquire these samples. A.R.H.

N81-28028*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MAGNETIC FIELD OF JUPITER: A GENERALIZED INVERSE APPROACH

J. E. P. Connerney Jun. 1981 50 p refs
(NASA-TM-82146) Avail: NTIS HC A03/MF A01 CSCL 03B

The estimation of planetary magnetic fields from observations of the magnetic field gathered along a spacecraft flyby trajectory is examined with the aid of generalized inverse techniques, with application to the internal magnetic field of Jupiter. Model nonuniqueness resulting from the limited spatial extent of the observations and noise on the data is explored and quantitative estimates of the model parameter resolution are found. The presence of a substantial magnetic field of external origin due to the currents flowng in the Jovian magnetodisc is found to be an important source of error in estimates of the internal Jovian field, and new models explicitly incorporating these currents are proposed. New internal field models are derived using the vector helium magnetometer observations and the high field fluxgate observations of Pioneer 11, and knowledge of the external current system gained from the Pioneer 10 and Voyagers 1 and 2 encounters. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N81-28029*# Stanford Univ., Calif. Inst. for Plasma Research

THE CRIMEAN SOLAR MAXIMUM YEAR WORKSHOP, SELECTED REPORTS

A. Gordon Emslie, Victor Gaizauskas (Herzberg Inst. of Astrophysics), and Shi Tsan Wu (Alabama Univ. in Huntsville) May 1980 91 p refs Workshop held at Nauchny, USSR, 24-27 Mar. 1981
(Grants NGL-05-020-272; NSF ATM-77-22482)
(NASA-CR-164528; SU-SUIPR-841) Avail: NTIS HC A05/MF A01 CSCL 03B

Problems associated with the transport of energy and acceleration of charged particles in solar flares are considered. Existing theories are compared with observation with a view to either discriminating between rival theories (such as whether hard X-rays are emitted by thermal or nonthermal bremsstrahlung), constraining existing theories (such as deduction of the number of nonthermal electrons present from spectroscopic diagnostics in the soft X-ray part of the spectrum), or suggesting theories (such as attempting to explain the observed spatial structure of microwave emission relative to alpha). S.F.

N81-28030*# Stanford Univ., Calif. Inst for Plasma Research

ON THE IMPORTANCE OF REVERSE CURRENT OHMIC LOSSES IN ELECTRON-HEATED SOLAR FLARE ATMOSPHERES

A. Gordon Emslie Oct. 1980 20 p refs
(Grants NGL-05-020-272; NAGw-92; Contract N00014-75-C-0673)
(NASA-CR-164527; SU-SUIPR-838) Avail: NTIS HC A02/MF A01 CSCL 03B

The passage of a beam of nonthermal electrons through the flaring solar atmosphere is considered, paying particular attention to the requirement that the beam be stable to the generation of plasma turbulence. The ratio is computed of energy losses due to reverse current ohmic heating, and heating by Coulomb collisions, respectively, for the greatest flux which can pass stably through the atmosphere. It is demonstrated that this ratio is determined by the low energy cutoff of the beam, by the electron temperature of the ambient atmosphere, and by the electron to ion temperature ratio. It is also independent of the atmospheric density. S.F.

N81-28031# Zeiss (Carl), Oberkochen (West Germany).

PETRA: SPECTROGRAPH FOR INVESTIGATING THE SOLAR ATMOSPHERE. FEASIBILITY STUDY OF A SPECTROGRAPH FOR SOLAR OBSERVATION IN THE VISIBLE SPECTRAL RANGE Final Report

Guenter Eck, Bernhard Doll, Peter Henneberg, Rainer Henkel, Hans-Juergen Meier, Helmut Raupp, and Rudolf Scharpf Bonn Bundesministerium fuer Forschung und Technologie Dec. 1980 395 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie Prepared in cooperation with Dornier-Werke GmbH, Friedrichshafen, West Germany
(BMFT-FB-W-80-014; ISSN-0170-1339) Avail: NTIS HC A17/MF A01

A space qualified solar research spectrograph is described. The apparatus PETRA is a spectrograph for solar observation in the visible spectrum which is to be used on a space shuttle as an instrument in the focus of a solar optical telescope with a 125 cm aperture. With suitable equipment, the favorable optical conditions in space make possible spatial resolutions of < 0.1 arc sec over a prolonged period of time. The prerequisites are high resolution mirror optics and mechanical stability. Author (ESA)

N81-28032*# Michigan Univ., Ann Arbor. Dept. of Aeronautical Engineering.

SOLAR OBSERVATIONS DURING SKYLAB APRIL 1973 - FEBRUARY 1974. 1: CORONAL X-RAY STRUCTURE. 2: SOLAR FLARE ACTIVITY

J. M. Hanson, E. C. Roelof (Johns Hopkins Univ., Silver Spring, Md.), and R. E. Gold (Johns Hopkins Univ., Silver Spring, Md.) Dec. 1980 50 p refs Sponsored in cooperation with AFGL
(Grant NsG-7055; Contract N00024-78-C-5384)
(NASA-CR-164428; PB81-167595; UAG-79; NOAA-81012912) Avail: NTIS HC A03/MF A01 CSCL 03B

Part 1: Large-scale emission features visible in soft X-ray photographs from the spectrographic telescope S-054 on Skylab have been superposed on Ha Synoptic Charts for Carrington Rotations 1601 through 1610. The charts identify loop arcades and loop complexes associated with strong magnetic fields, as well as coronal holes and areas devoid of emission loops. Although not adequate for the study of the geometry of individual features, the charts convey a global sense of coronal structure which is often difficult to obtain from individual (disk) images. Part 2: Charts of time versus longitude for each of Carrington Rotations 1600 - 1611 depict: (1) Ha importance, brightness, and location of confirmed flares; (2) peak flare X-ray flux 1-8 A; (3) peak flare decimetric radio intensity; and (4) flux of 1.8 - 4.5 Mev protons plotted at their high coronal emission longitude estimated from simulataneously measured solar wind velocity. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N81-28033*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
DATA ANALYSIS FOR THE HARD X-RAY EXPERIMENT ON BOARD THE ANS SPACECRAFT Final Report
Mar. 1978 14 p refs
(Contract NAS5-23282)
(NASA-CR-166682) Avail: NTIS HC A02/MF A01 CSCL 03B

An analysis of X ray bursts form globular clusters gathered by the Astronomical Netherlands Satellite is presented. Publications were prepared on the cosmic ray induced environment, and maps of these radiations as functions of latitude and longitude were generated. L.F.M.

N81-28034*# New Hampshire Univ., Durham.
ADVANCED GAMMA RAY BALLOON EXPERIMENT GROUND CHECKOUT AND DATA ANALYSIS Final Report, 19 Nov. 1974 - 30 Apr. 1976
M. Blackstone Jun. 1976 40 p
(Contract NAS5-20884)
(NASA-CR-166689; Rept-76-20884-01) Avail: NTIS HC A03/MF A01 CSCL 03B

A software programming package to be used in the ground checkout and handling of data from the advanced gamma ray balloon experiment is described. The Operator's Manual permits someone unfamiliar with the inner workings of the software system (called LEO) to operate on the experimental data as it comes from the Pulse Code Modulation interface, converting it to a form for later analysis, and monitoring the program of an experiment. A Programmer's Manual is included. S.F.

N81-27999# Kitt Peak National Observatory, Tucson, Ariz.
SPECTROSCOPIC EVIDENCE FOR COLLIMATED OUTFLOW
H. R. Butcher *In* ESA Opt. Jets in Galaxies Mar. 1981 p 39-41 refs Sponsored by NSF (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

N81-28004# Kitt Peak National Observatory, Tucson, Ariz.
OPTICAL EMISSION FROM THE EXTENDED RADIO SOURCE 3C 277.3 (COMA A)
Wil vanBreugel *In* ESA Opt. Jets in Galaxies Mar. 1981 p 63-67 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

N81-28005# Radio Sterrenwacht, Westerbork (Netherlands).
RECENT OBSERVATIONS OF LARGE ANGULAR SIZE RADIO JETS
A. G. Willis *In* ESA Opt. Jets in Galaxies Mar. 1981 p 71-76 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

N81-28006# National Radio Astronomy Observatory, Socorro, N. Mex.
RADIO JETS IN FLAT-SPECTRUM SOURCES
R. A. Perley *In* ESA Opt. Jets in Galaxies Mar. 1981 p 77-81 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

N81-28009# Consiglio Nazionale delle Ricerche, Bologna (Italy). Ist. di Radioastronomia.
JETS IN A SAMPLE OF LOW LUMINOSITY RADIO GALAXIES
R. Fanti and P. Parma *In* ESA Opt. Jets in Galaxies Mar. 1981 p 91-95 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

N81-28011# Netherlands Foundation for Radio Astronomy, Dwingelo. Dwingeloo Radio Observatory.
JETLIKE RADIOSTRUCTURE IN THE CORE OF 3C236
R. T. Schilizzi, G. K. Miley (Sterrenwacht Leiden), F. L. J. Jansen (Sterrenwacht Leiden), P. N. Wilkinson (Nuffield Radio Astron. Lab.), T. J. Cornwell (Nuffield Radio Astron. Lab.), and E.B. Fomalont (Natl. Radio Astron. Obs., Charlottesville, Va.) *In* ESA Opt. Jets in Galaxies Mar. 1981 p 107-108 refs (For primary document see N81-27993 18-88)
(Grant NATO-1828)
Avail: NTIS HC A08/MF A01

N81-28013# European Southern Observatory, Munich (West Germany).
X-RAY EMISSION FROM THE RADIO GALAXY 3C 668
M. Tarenghi and D. Maccagni (CNR, Milan) *In* ESA Opt. Jets in Galaxies Mar. 1981 p 115-116 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

N81-28014# Turin Univ. (Italy). Ist. di Fisica Generale.
OPTICAL JETS AND BEAM MODELS OF EXTENDED RADIO SOURCES
A. Ferrari, E. Trussoni, and L. Zaninetti *In* ESA Opt. Jets in Galaxies Mar. 1981 p 119-123 refs Prepared in cooperation with CNR, Milan (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

N81-28015# Maryland Univ., College Park. Astronomy Program.
COLLIMATED EJECTION OF RADIO EMITTING MATERIAL IN SEYFERT GALAXIES
A. S. Wilson *In* ESA Opt. Jets in Galaxies Mar. 1981 p 125-130 refs (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

N81-28016# Royal Observatory, Edinburgh (Scotland).
OPTICAL JETS IN ACTIVE GALAXIES
M. S. Longair *In* ESA Opt. Jets in Galaxies Mar. 1981 p 133-135 (For primary document see N81-27993 18-88)
Avail: NTIS HC A08/MF A01

99 GENERAL

N81-28035*# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
PROGRAM OF RESEARCH IN AERONAUTICS Annual Report, 1 Aug. 1980 - 31 Jul. 1981
25 Jun. 1981 65 p
(Contract NCC1-44)
(NASA-CR-164422) Avail: NTIS HC A04/MF A01 CSCL 05A

A prospectus of the educational and research opportunities available at the Joint Institute for Advancement of Flight Sciences, operated at NASA Langley Research Center in conjunction with George Washington University's School of Engineering and Applied Sciences is presented. Requirements of admission to various degree programs are given as well as the course offerings in the areas of acoustics, aeronautics, environmental modelling, materials science, and structures and dynamics. Research facilities for each field of study are described. Presentations and publications (including dissertations and theses) generated by each program are listed as well as faculty members visting scientists and engineers. A.R.H.

N81-28036*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FY 1980 SCIENTIFIC AND TECHNICAL REPORTS, ARTICLES, PAPERS, AND PRESENTATIONS
O. L. White, comp. Oct. 1980 67 p
(NASA-TM-78313) Avail: NTIS HC A04/MF A01 CSCL 05B

Abstracts are presented for 60 technical memoranda and 5 technical papers published in technical journals or presented

by MSFC personnel in FY 1980. Conference and reference publications are cited along with contractor reports and papers cleared for presentation. A.R.H.

N81-28037*# NASA Scientific and Technical Information Facility, Baltimore/Washington International Airport, Md. 21240.
INDEX TO NASA NEWS RELEASES AND SPEECHES
1980 165 p Sponsored by NASA
(NASA-CR-164557) Avail: NTIS HC A08/MF A01 CSCL 05B

A listing of news releases distributed by the Office of Public Affairs, NASA Headquarters, and a selected listing of speeches given by members of the Headquarters staff during 1979 are presented. M.G.

N81-28038# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LA RECHERCHE AEROSPATIALE, BIMONTHLY BULLETIN NO. 1981-1, JAN. - FEB. 1981
Claude Sevestre, ed. May 1981 68 p refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimensuel (Paris) no. 1981-1, Jan. - Feb. 1981
(ESA-TT-609) Avail: NTIS HC A04/MF A01; original FRENCH report available at ONERA, Paris FF 45

Articles concerning oscillating flow, multipath transmission and simulation of braking of a tire are presented. Error methods in stress modeling, nonlinear shell theory, hot wire anemometry and aerodynamic noise are discussed. For individual titles, see N81-28039 through N81-28045.

N81-28039# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LIFTING LINE ASYMPTOTIC THEORY IN COMPRESSIBLE OSCILLATING FLOW c34
Jean-Pierre Guiraud (Universite Pierre et Marie Curie) and Gilles Slama (Universite Pierre et Marie Curie) *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1981-1, Jan. - Feb. 1981 (ESA-TT-693) May 1981 p 3-8 refs Transl. by ONERA into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris), no. 1981-1, Jan. - Feb. 1981 (For primary document see N81-28038 18-99)
Avail: NTIS HC A04/MF A01; original FRENCH report available at ONERA, Paris FF 45

Harmonically oscillating wings of high aspect ratio are treated by matched asymptotic expansions. The reduced frequency computed with the chord is assumed to be of the order of unity. If epsilon is the small parameter, inverse of the aspect ratio, it is found that the first finite aspect ratio correction is 0 (epsilon squared Log epsilon) i.e., smaller than in the steady flow. The multiple scale phenomenon in the wake is shown to form a skin effect which prevents perturbation of order epsilon to pervade the far field. Author (ESA)

N81-28040# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EXPERIMENTAL STUDY OF MULTIPLE PATHS BY A BISTATIC METHOD OF SYNTHETIC APERTURE c32
Dominique Medynski, Joel Fritz, and Jacques Dorey *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1981-1, Jan. - Feb. 1981 (ESA-TT-693) May 1981 p 9-13 Transl. by ONERA into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris), no. 1981-1, Jan. - Feb. 1981 (For primary document see N81-28038 18-99)
Avail: NTIS HC A04/MF A01; original FRENCH report available at ONERA, Paris FF 45

A method for characterizing the spatial distribution of ground clutter around an omnidirectional antenna is described. The bistatic method is derived from that implemented in side looking radar. Absolute aircraft movement and movement in relation to a point on its trajectory are ensured by inertial systems and trajectography radar. Coherence of the transmitter and receiver is achieved by use of two atomic clocks. Signal processing consists of the following operations: (1) search for pulses corresponding to a scatterer M having a given position; (2) generating a replica corresponding to the theoretical phase evolution of these pulses; and (3) product and integration. This series of operations is repeated for all the possible positions of the point M. Tests over three types of terrain show good distinction between ground echoes with a low backscattering coefficient and those with a high reflectivity coefficient. Author (ESA)

N81-28041# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
BRAKING OF AN AIRCRAFT TIRE c37
Louis Anquez and Andre Monthulet *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1981-1, Jan. - Feb. 1981 (ESA-TT-693) May 1981 p 15-35 refs Transl. by ONERA into ENGLISH from La Rech. Aerospatiale, Bull. Bimensel (Paris), no. 1981-1, Jan. - Feb. 1981 (For primary document see N81-28038 18-99)
Avail: NTIS HC A04/MF A01; original FRENCH report available at ONERA, Paris FF 45

A numerical model was developed to predict the braking capacity of a tire on a runway of given characteristics. A local law representing the friction of rubber on a given runway was defined and a finite element of unilateral link friction created. A model of a Kleber-Colombes aircraft tire having 500 nodes and 1500 degrees of freedom was run (631 sec per iteration on a UNIVAC 1110), and gave a satisfactory comparison with test results. Calculation of the braking of a tire predicted within the tread, a zone of adherence and a zone of skidding and the evolution of the zones as a function of brake application.
Author (ESA)

N81-28042# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
AN ECONOMIC METHOD FOR CALCULATING PRECISE STRESS. LOCATION OF MODELING ERRORS c39
Philippe Gibert and Yves Gorge *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1981-1, Jan. - Feb. 1981 (ESA-TT-693) May 1981 p 37-45 refs Transl. by ONERA into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris), no. 1981-1, Jan. - Feb. 1981 (For primary document see N81-28038 18-99)
Avail: NTIS HC A04/MF A01; original FRENCH report available at ONERA, Paris FF 45

A method is proposed for the local calculation of statically admissible stresses, associated with an approximate displacement obtained by means of a primal finite element method. This calculation makes it possible to bring to light a local parameter of modelling errors. Its interpretation in terms of a consecutive error law allows the determination of the zones where the errors due to the model are too large relative to the measuring precision on the coefficients of the constitutive law. Examples are shown in a vibrational stress analysis problem and a thermal problem.
Author (ESA)

N81-28043# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Structures Dept.
THE PRINCIPLE OF COMPLEMENTARY ENERGY IN NONLINEAR SHELL THEORY c39
Roger Valid *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1981-1, Jan. - Feb. 1981 (ESA-TT-693) May 1981 p 47-57 refs Transl. by ONERA into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris), No. 1981-1, Jan. - Feb. 1981 Presented at 5th Intern. Congr. of Theory and Appl. Mech., Toronto, 17-23 Aug. 1980 (For primary document see N81-28038 18-99)
Avail: NTIS HC A04/MF A01; original FRENCH report available at ONERA, Paris FF 45

The principle of complementary energy in elasticity and large displacements, is extended to shell theory by means of a polar decomposition of the Jacobian mapping of the middle surface. Intermediate mixed and hybrid principles are also presented, as well as stress functions relative to this extension. In the linear case as in the three dimensional case, the method leads to the introduction of the symmetry of membrane stresses in weak form. Author (ESA)

N81-28044# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ON THE APPLICATION OF HOT-WIRE ANEMOMETRY TO THE SOLUTION OF PROBLEMS ARISING IN VARIABLE TEMPERATURE TURBULENT FLOWS c34
J. Gaviglio (CNRS, Marseille), J.-P. Anguillet (CNRS, Marseille), and M. Elena (CNRS, Marseille) *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1981-1, Jan. - Feb. 1981 (ESA-TT-693) May 1981 p 59-66 refs Transl. by ONERA into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris), No. 1981-1,

Jan. - Feb. 1981 (For primary document see N81-28038 18-99)
Avail: NTIS HC A04/MF A01; original FRENCH report available at ONERA, Paris FF 45

Hot wire anemometry of variable temperature turbulent flows is investigated. Equilibrium boundary layers at low subsonic speeds with heat sources, and at supersonic speeds, are considered. Specific problems encountered in the measurements of momentum and heat fluxes are discussed. Bandwidths are considered which are necessary to measure the variance of the signals corresponding to longitudinal velocity and temperature fluctuations. The variances of the signals corresponding to longitudinal and transverse fluxes at supersonic speeds are also considered. The influence of the Mach number of the location of the frequency range corresponding to energy containing eddies is examined. Author (ESA)

N81-28045# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

NOISE FROM LONGITUDINAL VORTICES **c02**

Robert Legendre *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1981-1, Jan. - Feb. 1981 (ESA-TT-693) May 1981 p 67-68 Transl. by ONERA into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris), no. 1981-1, Jan. - Feb. 1981-1 (For primary document see N81-28038 18-99)
Avail: NTIS HC A04/MF A01; original FRENCH report available at ONERA, Paris FF 45

A phenomenological discussion of aerodynamic noise is presented. Vortices from airplane wings, propellers or helicopter blades as well as from various lifting surfaces are examined as possible noise sources. R.C.T.

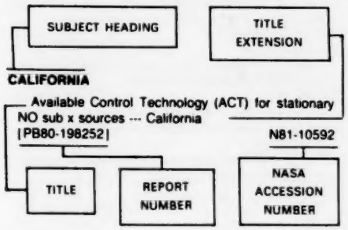
N81-28046# Office of Naval Research, San Francisco, Calif. Scientific Liaison Group.

ONR TOKYO SCIENTIFIC BULLETIN, VOLUME 6, NUMBER 1 JANUARY-MARCH 1981

Young B. Kim and Mary Lou Moore, ed. Mar. 1981 137 p refs
(AD-A099166) Avail: NTIS HC A03/MF A01 CSCL 08/6

This is a quarterly publication presenting articles covering recent developments in Far Eastern (particularly Japanese) scientific research. It is hoped that these reports (which do not constitute part of the scientific literature) will prove to be of value to scientists by providing items of interest well in advance of the usual scientific publications. The articles are written primarily by members of the staff of ONR Tokyo, with certain report also being contributed by visiting stateside scientists. Occasionally a regional scientist will be invited to submit an article covering his own work, considered to be of special interest.Author (GRA)

Typical Subject Index Listing



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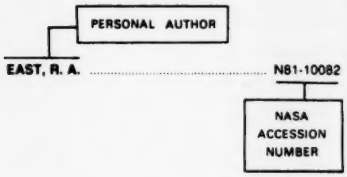

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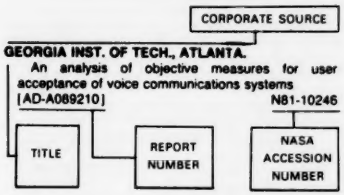

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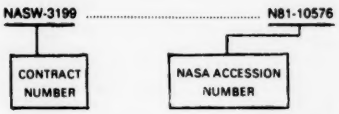

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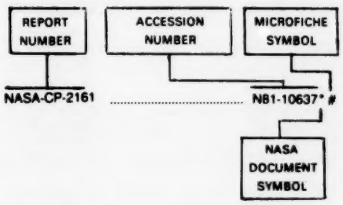

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